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NOTES ON AGRICULTURAL DEVELOPMENT, CENTRAL DISTRICT.

BY G. B. BROOKS, Instructor in Agriculture.

Occasionally one hears a remark to the effect that conditions in the Central District are generally unfavourable for farming, and that agriculture is not likely to become an important industry. Fortunately, this view is invariably given expression to by those who, in regard to the conditions obtaining, have little or no knowledge.

Should evidence be required of the development that has recently taken place, one has only to peruse a map dating back a few years, when it will be found that our closely settled districts, such as Barmoya, Mount Larcom, Dawson Valley, Ridgelands, Marlborough, Boyne Valley, Targinnie, and Rosslyn are not placed.

It must be admitted that the settlers in some of the districts mentioned have had to face some adversity but it must also be remembered that during recent years the seasons along the eastern seaboard of Australia have been rather erratic, and the man who embarked on the land with little or no capital naturally had a hard row to hoe. Moreover, it is a well-recognised fact that newly populated districts are invariably handicapped through a large proportion of the settlers having had no previous knowledge of agriculture; also that it takes a district, even given the most favourable seasons, a few years to gain momentum. Several of the abovementioned sub-districts have reached what may be termed the well-to-do stage; others are about to enter, while a few which have just recently been put on the map are still in the pioneering stages.

Experienced farmers in the respective localities have already disproved the statement that these closely populated areas are outside the safe limit for successful crop production, and have demonstrated in no uncertain manner that conditions of soil and climate are equally favourable to those obtaining in other portions of the State. Those tests have not been carried out on garden patches, but on a fairly extensive scale. I can, for example, name a farmer who has, during a single year, raised over 100 acres of English potatoes; another, 500 acres of maize; while in another district there is a single patch of 100 acres of cotton being planted.

Dairying as an industry is certainly destined to assume a position of very great importance in the near future. During recent years tremendous areas of scrub have disappeared, and in its place are waving fields of Rhodes grass.

A feature invariably overlooked in connection with dairying in Central Queensland is the absence of extremes in temperature. It is, therefore, infinitely easier to keep animals in good condition and returns from the factory at a higher level than would be the case were the herds exposed to heat waves during the summer or cold westerly winds during the winter months. The fact that Central Queensland has carried off champion honours in the District competitions at the National Show, Brisbane, both in regard to agricultural products and fruit, and that it so far has been the only district in Queensland to enter the lists against those of the mother State, at the Sydney Royal, is an indication that its agricultural possibilities cannot altogether be ignored.

There are several important industries in process of development in Central Queensland that will eventually have a direct bearing on agricultural expansion by providing local markets for farm produce. Enormous deposits of high-quality metalliferous ores, coal, marble, limestone, and other minerals must eventually support a huge industrial population. The famous Mount Morgan gold and copper mine exists within its boundaries; the whole district is well served by railways; and on its coast is one of the finest harbours on the Australian seaboard.

These notes are the first of a descriptive series on the agricultural areas and possibilities of this well-endowed district, and the order in which localities are mentioned has no relation to their importance.

WOWAN DISTRICT.

The closely settled area of country extending from Dululu to Rannes, drained by the Dee and Don Rivers, has, by its proximity to the Dawson Valley Railway Line, been erroneously named "the Dawson Valley district." The Dawson River, by the way, is some 40 miles distant.

Before the advent of the railway, Dundee (now Deeford), rather prettily situated on the banks of the Dee, was the only township in those parts, but, having failed to find favour with the railway surveyor—no doubt on account of adjacent low-lying country subject to flooding—the neighbouring railway station, Wowan (native name for scrub turkey), became the centre.

When it is considered that only a few years ago the district was portion of a cattle run, the progress made has been remarkable. In Wowan most of the activities essential to an agricultural district are represented.

Physical Characteristics.—The greater portion of the district is of a gently undulating character. It is bounded on the west by the Dee Ranges, and watered by two rivers—the Dee and the Don. There are also several creeks, the most important being Alma, Pheasant, and Callide. The Dee River was brought before public notice a few years ago by the sensational finding of large nuggets of gold near its source. Towards the south-eastern portion of the district there are two fairly large stretches of water—Lake Caroline and Lake Victoria.

Although not generally known, there are large quantities of limestone in the district, the deposit running parallel with the Dee Ranges, while lime in a granular or earthy condition is also to be found in immense quantities. Samples secured from various localities and submitted for analysis show calcium to be present equal to 60 per cent. carbonate of lime. Marble has also been located in places, but the extent of the deposit has not been determined.

Climatic Conditions.—The average annual rainfall for the district is in the neighbourhood of 30 inches. Several comparatively dry seasons, which, by the way, were more severe in other parts of the State, were experienced subsequent to the opening of the land for settlement. This put a very heavy strain on the financial resources of the settlers, most of whom were depending entirely on the maize crop as a means of support. During the first year very extensive areas of scrub were cut down, mostly adjacent to the main roads. This was all practically burned off and planted with maize about the same date. Unfortunately, when at the critical stage, a hot, dry spell adversely affected the entire crop. Better fortune was experienced in following seasons.

Soils.—The Wowan district is particularly fortunate in its soils, both in regard to quality and the large proportion of land that is available for cultivation; in fact, on a great many farms practically every inch is fit for the plough.

To the east of the Dee, where the country was originally timbered with brigalow, the soil is a brown friable loam of excellent quality. Adjacent to Alma Creek there are large stretches of alluvial forest flats on which are to be found growing lucerne, maize, cotton, and other crops.

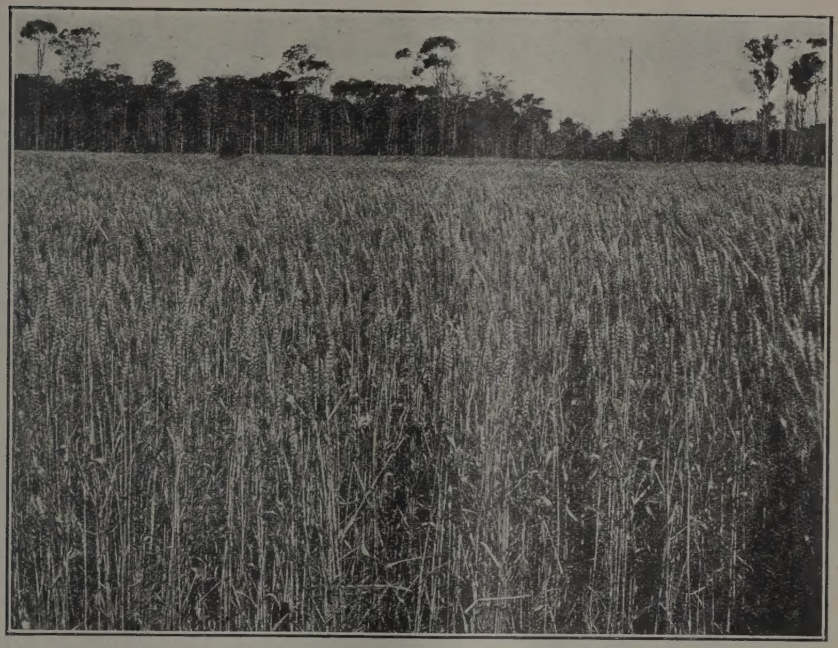

PLATE 63.—FODDER DEMONSTRATION PLOTS ON FARM OF A. E. G. BARNARD, WOWAN. VARIETY, PATRIOT WHEAT.

PLATE 64.—WOWAN, DAWSON VALLEY: A RAPIDLY GROWING DAIRYING CENTRE.

PLATE 65.—FODDER DEMONSTRATION PLOTS, A. E. G. BARNARD, WOWAN. VARIETY, FLORENCE WHEAT.

PLATE 66.—PROMISING CROP OF BROWNELL POTATOES, TAKEN SEVEN WEEKS AFTER PLANTING. GROWN BY E. C. VALLIS, DOUBLE CREEK, DEEFORD.

PLATE 67.—A PROLIFIC COTTON PLANT, DURANGO VARIETY, GROWN IN WOWAN DISTRICT

Between the Dee River and the railway line, and extending from Dululu to the junction of the Don, the soil is mostly of an alluvial nature. From the railway to the Dee Ranges, which includes the Pheasant Creek district, the country is of a more variable character, and is made up principally of brigalow and softwood scrubs, interspersed with patches of forest, timbered mainly with gum, ironbark, and bloodwood.

To the south of the Don, where it junctions with the Dee at almost right angles, there is an immense stretch, consisting of thousands of acres of rich alluvial flat country, large portions of which are excellently adapted for the raising of lucerne, potatoes, and other valuable products. The distance to the railway, from 10 to 12 miles, has no doubt retarded development; also the fact that there are low portions which, during heavy floods, would probably be subject to inundation.

Lines of Development.—With the majority of settlers the chief objective is dairying. The procedure therefore has been the falling of the scrub, cropping with maize, and seeding down in Rhodes grass. That those interested are not lacking in enterprise is shown by the erection of a co-operative butter factory at Wowan. This industry has been somewhat handicapped through the difficulty in obtaining, owing to the distance from old-established dairying centres, the type of dairy animal desired. Stock from high-producing herds are, however, gradually being brought into the district.

Hitherto the principal crop raised has been maize, but the guaranteed price of 5½d. per lb. for cotton in the seed has been an incentive to increased production of that product. Last season the area under cotton was approximately 230 acres, the return from which brought into the district over £4,300 in hard cash. This gives an average yield per acre of 800 lb., valued at £18 10s. The returns given may be considered very satisfactory, more particularly when, in many instances areas were planted too late in the season to ensure a full crop.

There has been a considerable increase in the area sown for the 1921-2 crop, a rough estimate being 2,000 acres. Last season there were several farmers who had patches of about 30 acres. This season it is expected that the 100-acre mark will be passed.

Departmental Activities.—The Department of Agriculture, through its instructors, are giving every assistance to the man on the land. Plots have been established in several localities for the purpose of demonstrating the best kinds of fodder crops to grow in order to provide herds with winter feed. Practical demonstrations have been given in stack-silage making, also in the raising of suitable crops for fodder conservation.

The farmers are practically co-operating with the Department in carrying out various tests, the results obtained being considered of very great value.

The accompanying illustrations show the fine results obtained from the present season's fodder crops grown on the farm of Mr. A. E. G. Barnard.

An asset to the district is the valuable stud shorthorn herd located at Calliungal, and owned by Mr. J. L. Wilson. Mr. Wilson evidently recognises the importance of the fact that judicious feeding must go hand in hand with successful breeding. Judging by the provision made in regard to fodder conservation, his motto appears to be "One paddock one silo," for on two of his properties—Calliungal and Calliope—he has erected nine silos. Dairymen please note.

DIRECTIONS FOR PLANTING UPLAND COTTON.

Cosmopolitan Character of Plant.—Under favourable climatic conditions, cotton will thrive on a great variety of soils.

A well-drained soil and a sheltered situation should be chosen.

Drought-resistant Habit.—The plant is a deep rooter, and naturally drought-resistant once it is firmly established, but responds to good cultivation and will return heavier crops where the surface soil is thoroughly prepared beforehand and moisture stored up in the subsoil and conserved by regular cultivation for the use of the growing crop.

Well-prepared Land Essential.—Land that is ploughed and cross-ploughed (not necessarily deep), say to a depth of 6 or 7 in., should be worked up to a good tilth on the surface prior to the seed being sown. In this way germination is assisted and a supply of plant-food made readily available.

A Good Crop for Scrub Land.—Cotton is a suitable crop for, and thrives well on, naturally burnt-off scrub land, the seed being sown in "hills" amongst the stumps and logs. Two or three seeds are sown to each "hill," spaced about 2 ft. apart.

Thinning should be carried out when the plants reach a height of from 6 to 8 in., the strongest plant being allowed to remain.

Weeds should be destroyed by hand cultivation and the surface soil surrounding the plants kept in a loose, friable condition.

Sowing Seed on Cultivated Land.—Five or six pounds are sufficient for an acre when care is exercised in planting.

Where a single-horse maize drill is used for planting the seed, very light furrows may be run out 4 ft. apart with the plough, and the seed drilled in the furrows, or a marker may be used, marking three rows at a time. Prompt harrowing immediately after these operations is necessary.

Rapid and economical planting is assured by the use of a two-row maize planter.

Distances between Plants in the Row.—A good average space between young growing plants is from 8 to 10 in. It is necessary, however, to thin these out when they are several inches high, leaving one strong plant at intervals of from 20 to 24 in.

Wide planting of upland cotton induces the formation of "vegetative" (woody) branches, to the detriment of the "flowering" (bud-bearing) branches, and a consequent reduction in its cropping capacity.

Treatment of Seed.—Owing to the short fluffy fibres adhering to the seed, it must be treated prior to attempting to pass it through a drill. Puddled clay or flour paste is commonly used for this purpose. Seed is dipped, in small quantities, into a vessel containing either of the above mixtures, the best consistency for which is readily ascertainable by a little practice. That treated with puddled clay should be rolled by hand on a sieve or other suitable surface, and the seeds made up to resemble small marbles, which must be allowed to dry out in the sun; when drying out, careful handling is necessary.

The flour-paste-treated seed is dipped into the prepared paste and drained and dried so that the seeds do not stick together.

Time to Plant.—Other things being favourable, the time for planting seed varies according to climatic conditions ruling in any particular district, and may be carried out as soon as danger from frost is over—up to October, and, in some localities, November.

Period of Maturity.—The crop takes from four to four and a-half months to mature. As the whole of the bolls do not ripen at once, it is necessary to go through the crop every few days and gather those which are thoroughly dry and have fully exposed their cotton.

Harvesting.—Picking should not commence until the dew has completely dried off the cotton.

The strictest care should be exercised to keep the seed cotton free from leaves, sticks, dirt, or foreign matter of any description, and stained or discoloured cotton should not be mixed with the clean, sound, marketable sample.

Clean bags or bales must be used for the reception of the crop. These should be legibly branded before despatch to their destination.

SOME NOTES ON THE SOILS AND FOREST FLORA OF THE DIVIDING RANGE—NORTH OF ROMA.

By H. I. JENSEN, D.Sc. (Syd.).

(Continued from October Journal.)

We find prickly-pear in various places along the foreshores of Deception Bay, where seaspray is carried over the land, and back from the sea over areas which have been only recently salt marshes or arms of the sea. The pear does not spread back over the leached soils of the higher lands, because these soils contain no salts. With a view of testing this explanation, the writer collected three type soils—

No. 460.—Typical brigalow soil with dense pear spreading fast, 40 miles north of Roma-Durham Downs road.

No. 461.—Typical belah soil, with some pear, healthy but not spreading as fast as in the brigalow. Same road, 30 miles north of Roma.

No. 462.—Typical box soil. Some pear, but not healthy. 35 miles north-west of Roma, on Cornwall Station.

Mr. E. H. Gurney, Chemist of the Queensland Department of Agriculture and Stock, kindly made an analysis of the water-soluble constituents of these three soils.

The result was most interesting and instructive, and show that valuable information may be gained by following this line of research.

——	No. 460.	No. 461.	No. 462.
	Per cent.	Per cent.	Per cent.
Soluble silica	·0068	·0036	·0068
Sodium chloride (common salt)	·0140	·0083	·0068
Sodium sulphate (white alkali)	·0085	·0122	Nil
Sodium carbonate (black alkali)	·0252	·0134	Nil
Magnesium chloride	Nil	Nil	·0012
Magnesium sulphate	Nil	Nil	Nil
Magnesium carbonate	·0012	·0017	·0004
Calcium chloride	Nil	Nil	Nil
Calcium sulphate (gypsum)	Nil	Nil	·0046
Calcium carbonate	·0264	·0286	·0054
	·0821	·0675	·0252
Total soluble	·1021	·1200	·0444
Organic matter, &c.	·0200	·1525	·0192

It may be stated that No. 460 was a calcareous shale soil—very heavy clay. No. 461 was a calcareous sandstone soil—a light friable chocolate loam. No. 462 was a somewhat stiff shale soil, from aluminous rather than calcareous shale.

It is interesting to note that the brigalow scrub was remarkably high in common salt and both white and black alkali, which is exactly what was expected.

The very alkaline and saline brigalow country is pure brigalow-prickly-pear scrub, with very little admixture of other vegetation. Where the country is less alkaline we get with the brigalow some belah (*Casuarina lepidophloia*), box (*Eucalyptus populifolia*), wilga (*Geijira parviflora*), sandalwood (*Eremophila Mitchelli*), whitewood (*Atalaya hemiglauca*), bottle-tree (*Sterculia rupestris*), currajong (*Sterculia diversifolia*), orange (*Canthium buxifolium* and *Canthium oleifolium*), pomegranate or orange (*Capparis Mitchelli*), mulpup (*Capparis lasciantha*), myall (*Acacia pendula*), red ash (*Alphistonia excelsa*), emu apple (*Owenia acidula*), buttercup bush (*Cassia eremophila*), and numerous other things less distinctive.

Brigalow-Belah Country.—This is country in which brigalow and belah occur together in almost equal proportions. The soil is heavy, but not as heavy as those previously discussed. It has a clay subsoil and overlies arenaceous shales rich in lime. It can be successfully cultivated and should suit some varieties of cereals, which, no doubt, the Agricultural Department can recommend.

The vegetation is much the same as that given for the less-alkaline brigalow soils. Wilga, myall, sandalwood, emu apple, and bottle trees occur in the scrubs.

Belah Country.—Where the belah forms scrubs by itself, the soil is usually a sandy loam with a porous subsoil overlying sandstone formation rich in lime; in fact, calcareous sandstone. Belts of this rock are frequent in the Walloon formations between Roma and Injune. These soils are of excellent mechanical texture, rich in plant-food and easy to clear, and rank easily with the river alluvials as the best agricultural soils in the area. As Mr. Gurney's water-soluble analyses show, the type belah soil is not excessively charged with alkali.

These soils should grow good fruit orchards, and should be fine wheat soils. They are also, when cleared, excellent grass lands.

Sandalwood Country (Sandalwood—*Eremophila Mitchelli*).—The soil is usually loamy and of a chocolate colour. It is fair to good in mineral plant-food, but it has a clay subsoil which makes it favourable for the cultivation of cereals, but not too good for fruit trees. The subsoil is very impervious; hence this class of country is good for dam and tank construction. It is well grassed.

Associated with sandalwood we usually get some box and silverleaf ironbark (*Eucalyptus melanophloia*), the latter where a stony formation gets close to the

surface. The other associated trees are myall (*Acacia pendula*), wilga (*Geijera parviflora*), whitewood (*Atalaya hemiglauca*), emu apple (*Owenia acidula*), and orange (*Capparis Mitchelli*). The soil is free from excessive salinity, but has a high absorptive power for water, and hence gets very boggy after rain.

Box (*Eucalyptus populifolia, poplar box*) *Country.*—The soil on which the poplar box holds sway is usually a grey clay soil, fair in mineral plant-food, but rather too heavy for cultivation and generally inclined to be sour. It holds water well, but has poor capillary powers, differing in that respect from the sandalwood country.

Associated with box we may get, on the one hand, a sprinkling of the belah scrub timbers or of the sandalwood country timbers, or, on the other hand, silver-leaved ironbark if the stone is near the surface.

Sometimes we get a fair amount of poplar box on felspathic sandstone country, where, however, it is subordinate to pine, Moreton Bay ash (*Eucalyptus tesselaris*), sugar-gum (*Angophora lanceolata*), and tumbledown gum (*Eucalyptus dealbata*). This class of country is poor in lime, but typical box country is fair in lime.

Sandalwood with box country is usual on shale and felspathic sandstones with fair lime content.

Silverleaf (*Eucalyptus melanophloia*) *Country.*—This ironbark south of the Dividing Range is usually characteristic of soils of fair quality but not deep. The rock is near the surface. It is country which has a good mechanical composition, but owing to the soil being shallow it is liable to dry out very quickly in dry weather. The grass is good in good seasons, but bad in bad seasons. We get the silverleaf mainly on felspathic and calcareous sandstone, while pine dominates on silicious sandstones. The commonest associate of silverleaf is poplar box.

Pine Country (*Pine—Callitris glauca*).—Pine is characteristic of the most silicious of sandy soils. It is poor country, very deficient in mineral plant-food though good in mechanical texture. Pine country is found on silicious sandstones. It will grow fair wheat crops in favourable seasons for a year or two, but soon gets exhausted and then needs heavy manuring. The grasses are poor or useless. Spinifex is often the main grass.

While pure pine scrubs occur on the driest of sandy areas, wherever moisture conditions are better or the soil is a little more clayey, we get associated with pine silverleaf ironbark, Moreton Bay ash, sugar gum, crooked gum (*E. dealbata*), apple (*Angophora intermedia*), yellow bloodwood (*Eucalyptus trachyphloia*), quinine (*Petalostigma quadriloculare*), dogwood (*Jacksonia scoparia*), cherry (*Exocarpus cupressiformis*), grevilleas, hakeas, wattles (most widespread of which is *Acacia Cunninghamii*), pear (*Xylometon pyriforme*), and rosemary (*Cassinia levis*). Amongst other plants collected on poor sandy country on the Walloon belt, between Roma and Injune, are *Hoovea longipes, Eucalyptus decorticans, Acacia doratoxylon, Acacia decora, Acacia decurrens, Acacia macradenia, Acacia podolyriæfolia, Casuarina inophloia, Lysicarpus termifolius, Dodonea viscosa, Cassia eremophila,* &c. This great retinue of shrubs occurs on the dry pine areas and on the stringybark areas in sandstone country where the soil is shallow and dry. Stringybark (*Eucalyptus acmenioides*) is found only on hills and tablelands in sandstone together with pine, woolly oak (*Casuarina inophloia*), *Acacia Bancrofti*, and budgeroo (*Lysicarpus ternaifolius*). In wet places or on very deep sandy soils with high capillary power we get *Moreton Bay Ash-Sugar Gum Country.*—This country is poor in plant-food but grows good crops for a few years, when fertilisers become essential. In this class of country we have open forest. The chief associate timber is tumbledown gum. Sugar gum and Moreton Bay ash are invariably on sandstone formation. Along creeks and near springs the apple (*Angophora intermedia*) and red gum (*Eucalyptus tereticornis*) accompany the abovementioned timbers.

The Basaltic Lands around Mount Hutton.—These yield rich chocolate loams and, in ill-drained places on tablelands, black soils. They grow excellent grass and herbage and, where the soil is chocolate and the country not too steep, should yield excellent agricultural land. The area of suitable land is, however, not great.

The timbers present on the basalt are chiefly box (*Eucalyptus hemiphloia*), coolibah (*E. microtheca*), and silverleaf ironbark (*E. melanophloia*).

Gilgai Country occurs in brigalow and brigalow-belah scrubs. It is rich in plant-food, but too alkaline and stiff, as well as too uneven, to be suited for cultivation. The origin of gilgais is supposed to be due to the high expansion and contraction of the soil on wetting and drying.

BOILED COTTON SEED AS STOCK FOOD.

By E. Graham, Chief Dairy Expert.

Owing to the increased attention that is now being given to the growing of cotton by farmers in this State, there is a correspondingly larger amount of cotton seed available each year, as feed for stock, and it is of more than passing importance that simple and inexpensive methods of preparing the cotton seed before use in feeding to stock should be understood generally.

A great deal of valuable information concerning the utilisation of cotton seed for stock-feeding purposes has been supplied by officers of this Department, and the same has been available to dairymen interested, through the medium of the Journal, from time to time. While it is widely recognised that cotton seed is comparatively high in nutriment, as a fodder, it has failed to grow into general use as a feed for dairy stock, partially on account of the difficulty attendant to the removal, by means of crushing or other device, of the hornlike substance of the shell which covers the kernel of the seed. However, as the result of experience which has been gained by the feeding of cotton seed, after boiling, to stock, the indications are that the crushing of the seeds and the removal of the shells are not really imperative.

For some time past it has been the practice of several dairymen to feed boiled cotton seed to the dairy cows, and the results to date go to show that the boiled cotton seed is quite satisfactory for use as a concentrate for feeding in conjunction with other fodders, such as white straw chaff, sorghum, cow-cane, &c.

The method of boiling the seed is as follows:—Place sufficient of the seed to meet the requirements of the herd for a day in a copper or other receptacle, and add enough water to cover the seed; then bring to a boil. The boiling should be continued for fifteen to twenty minutes, and by this time it will be found that the shells have been reduced to a sufficiently soft condition to allow of the kernels of the seed being pressed out of the shells with comparative ease. It is noticeable, also, that the shells, by boiling, lose a great deal of their original toughness, and it is highly possible, too, that the shells in this state are more readily digestible.

As the seeds have a tendency to float on water, it is advisable to cover the top of the receptacle in which the boiling is carried out; when this is done it is unnecessary to stir the seeds during boiling.

If boiled in an open vessel, it is best to press the seeds into the boiling water rather than to stir them, because harsh agitation of the seeds when the shells are softened causes the shells to break and the contents to be lost as feed.

After boiling is completed the superfluous water may be run off, and the seed is then ready for feeding purposes.

The boiled seeds do not ferment readily; consequently ample seed may be boiled at one time to fill the requirements for the day. It is estimated that 2 lb. of the boiled seed is approximately equivalent to 1 lb. of the dry seed.

Animals partaking of the cotton seed are healthy in appearance, and no difficulty is experienced in getting cows to take cotton seed in a boiled form.

OSTEOMALAGIA OR SOFT BONE.

When animals are suffering from this disease, which is very prevalent in some districts of Queensland (particularly on the North Coast Line), it is generally due to an insufficiency of lime in the soil.

The Chief Inspector of Stock (A. H. Cory, M.R.C.V.S.) recommends that the following lick be given in the manner described:—

Bone meal	1 lb.
Carbonate of iron	4 oz.
Gentian	4 oz.
Common salt	8 oz.
Foenugreek	4 oz.

One or two tablespoonfuls to be allowed each animal twice daily in food.

Dairying.

THE DAIRY HERD, QUEENSLAND AGRICULTURAL COLLEGE, GATTON.

MILKING RECORDS OF COWS FOR SEPTEMBER, 1921.

Name of Cow.	Breed.	Date of Calving.	Total Milk.	Test.	Commercial Butter.	Remarks.
			lb.	%	lb.	
Thyra of Myrtleview	Ayrshire ..	31 July, 1921	1,480	3·7	60·93	
Miss Security ...	,, ...	20 Aug. ,,	1,502	3·6	60·08	
Iron Plate	Jersey ...	12 July ,,	1,015	4·9	58·45	
Affection of Gowrie Park	Ayrshire ...	8 Aug. ,,	1,223	3·9	53·31	
Bellona	,, ...	26 June ,,	1,159	3·9	50·48	
College Mignon ...	Jersey ..	7 July ,,	809	5·1	48·47	
Prim	Holstein ...	9 Mar. ,,	1,178	3·5	45·41	
Hedges Madge ...	,, ..	15 Aug. ,,	1,171	3·5	45·32	
Miss Betty ...	Jersey ...	7 July ,,	789	4·1	36·23	
College Cold Iron	,, ...	10 Mar. ,,	685	4·3	32·95	
Gatton Glitter ...	Guernsey ...	9 Sept. ,,	630	4·7	32·60	
Yarraview Village Belle	,, ...	6 Aug. ,,	543	5·1	32·53	
Hedges Nattie ..	Holstein ...	26 Feb. ,,	693	3·7	28·52	
Glow VI.	Guernsey ...	28 Aug. ,,	654	3·9	28·38	
College Cobalt ...	Jersey ...	6 Jan. ,,	510	4·8	27·59	
Netherton Belle ..	Ayrshire ...	30 Oct., 1920	570	4·3	27·48	
Magnet's Leda ...	Jersey ...	6 Oct. ,,	516	4·6	26·76	
Charming Damsel	Ayrshire ...	12 May, 1921	598	3·8	25·40	
Miss Fearless ...	,, ..	26 May ,,	615	3·7	25·20	
Wattle Blossom ...	Guernsey ...	21 May ,,	428	5·0	25·14	
Rosine	Ayrshire ...	19 Jan. ,,	591	3·8	25·01	
Comedienne ...	Jersey ...	26 Nov., 1920	460	4·8	24·88	
Dawn of Warragaburra	,, ...	15 Oct. ,,	461	4·7	24·38	
Royal Mistress ...	Ayrshire ...	19 Mar., 1921	571	3·7	23·46	
Lilia	,, ...	3 April ,,	523	4·0	23·35	
Confidence... ...	,, ...	8 Feb. ,,	508	4·1	23·25	
Hedges Dutchmaid	Holstein ...	26 May ,,	618	3·4	23·24	
Confidante ...	Ayrshire ...	12 May ,,	479	4.3	23·09	
College Ma Petite	Jersey ...	23 Dec., 1920	374	5·0	21·97	
Thornton Fairetta	,, .	15 Mar., 1921	360	5·1	21·57	
Snowflake	Shorthorn...	21 Dec., 1920	476	4·0	21·35	
College Grandeur	Jersey ...	29 Dec., ,,	420	4·5	21·24	

EXAMPLES OF RATIONS FOR PIG-FEEDING.

BY E. H. GURNEY AND V. S. RAWSON.

Standard ration as given by Kellner for pigs 100 lb. weight: -Dry matter, 3·6; digestible protein, ·45; digestible fat, ·09; starch equivalent, 3·20.

To compound a ration giving approximately these quantities of substances, it is necessary to first look up the analysis of the foodstuffs and to calculate on these figures.

For instance, a ration consisting of maize, skim milk, lucerne, and swedes:—

	PARTS PER HUNDRED.			
	Dry Matter.	Digestible Protein.	Digestible Fat.	Starch Equivalent.
Maize	87	6·8	4·3	81·8
Skim milk	10	3·8	0·2	7·6
Green lucerne	19	2·7	0·4	8·7
Swedes	12	0·3	..	7·5
RATION No. I.—LB. OF SUBSTANCES.				
3 lb. maize	2·61	·20	·13	2·45
5 lb. skim milk (½-gallon)	·50	·19	·01	·38
1 lb. green lucerne	·19	·03	..	·09
4 lb. swede turnips	·48	·01	..	·30
	3·78	·43	·14	3·22
RATION No. II.—FURTHER EXAMPLES.				
3 lb. barley	2·58	·18	·06	2·16
5 lb. skim milk (½-gallon)	·50	·19	·01	·38
1 lb. sweet potatoes	·31	..	..	·24
3 lb. green lucerne	·57	·08	·01	·26
	3·96	·45	·08	3·04
RATION No. III.				
3 lb. barley	2·58	·18	·06	2·16
5 lb. skim milk	·50	·19	·01	·38
3 lb. mangel	·36	..	..	·19
3 lb. lucerne	·57	·08	·01	·26
	4·01	·45	·08	2·99
RATION No. IV.				
1¾ lb. barley	1·50	·11	·03	1·26
1½ lb. sorghum (seed)	1·27	·06	·04	1·02
5 lb. skim milk	·50	·19	·01	·38
3 lb. green lucerne	·57	·08	·01	·26
	3·84	·44	·09	2·92
RATION No. V.				
2 lb. pollard	1·78	·20	·06	1·36
5 lb. skim milk	·50	·19	·01	·38
2 lb. green lucerne	·38	·06	·01	·18
5 lb. sweet potatoes	1·55	..	..	1·20
	4·21	·45	·08	3·12
RATION No. VI.				
3 lb. barley	2·58	·18	·06	2·16
5 lb. buttermilk	·50	·19	·05	·46
3 lb. cowpeas	·60	·06	·01	·28
1 lb. English potatoes	·25	..	..	·19
	3·93	·43	·12	3·09

	PARTS PER HUNDRED.			
	Dry Matter	Digestible Protein.	Digestible Fat.	Starch Equivalent.
RATION No. VII.				
3 lb. barley	2·58	·18	·06	2·16
5 lb. buttermilk	·50	·19	·05	·46
3 lb. cowpeas	·60	·06	·01	·28
3 lb. mangels	·36	..	..	·19
	4·04	·43	·12	3·09
RATION No. VIII.				
1¾ lb. barley	1·50	·11	·06	1·26
1½ lb. sorghum (seed)	1·27	·06	·04	1·02
5 lb. buttermilk	·50	·19	·05	·46
3 lb. green lucerne	·57	·08	·01	·26
	3·84	·44	·16	3·00
RATION No. IX.				
2¼ lb. wheat	1·96	·20	·03	1·61
5 lb. skim milk	·50	·19	·01	·38
2 lb. green lucerne	·38	·06	·01	·18
4 lb. sweet potatoes	1·24	..	..	·96
	4·08	·45	·05	3·13
RATION No. X.				
3 lb. wheat	2·74	·27	·04	2·14
4 lb. skim milk	·40	·15	·01	·31
2 lb. rape	·28	·02	·02	·14
12 lb. pumpkin	·96	·04	·02	·48
	4·38	·48	·09	3·07
RATION No. XI.				
2¼ lb. maize	1·96	·16	·10	1·84
5 lb. skim milk	·50	·19	·01	·38
4 lb. green lucerne	·76	·11	·02	·35
1 lb. molasses	·76	..	..	·48
	3·98	·46	·13	3·05

EXAMPLES OF CALCULATING RATIONS.

Referring to Ration I. we see that 100 lb. of maize contain 87 lb. of dry matter, therefore 3 lb. contain $\frac{3}{100} \times \frac{87}{1}$ = lb. 2·61 lb.

Similarly 100 lb. of maize contain—
6·8 lb. of digestible protein,
4·3 lb. of digestible fat,
81·8 lb. of starch equivalent.

Hence 3 lb. of maize contain—

$\frac{6{\cdot}8 \times 3}{100}$ lb. of digestible protein = ·204 lb.

$\frac{4{\cdot}3 \times 3}{100}$ lb. of digestible fat = ·129 lb.

$\frac{81{\cdot}8 \times 3}{100}$ lb. of starch equivalent = 2·454 lb.

Having obtained these figures in a similar way for all the foodstuffs to be supplied, we are able to calculate therefrom, by addition, the sum total of our food substances.

Let it be presumed, then, one is considering the compounding of a ration containing the same fodders, but in different quantities, *e.g.*, 2 lb. of maize, 5 lb. of skim milk, 5 lb. of green lucerne, and 2 lb. of swede turnips. The calculation is made on a similar basis to that mentioned above.

——	Dry Matter.	Digestible Protein.	Digestible Fat.	Starch Equivalent.
2 lb. maize	1·74	·14	·09	1·64
5 lb. (½-gallon) skim milk	·50	·19	·01	·38
5 lb. green lucerne	·95	·14	·02	·44
2 lb. swede turnips	·24	·01	..	·15
	3·43	·48	·12	2·61

The foregoing ration is nearly correct in the dry matter, but there is too high an amount of digestible protein (thus causing a waste); also the amount of starch equivalent is much too low. This latter is to be remedied without increasing the amount of digestible protein, and at the same time only slightly increasing the amount of dry matter. It is proposed to do this by the addition of 1 lb. of maize.

1 lb. of maize contains—

·87 lb. of dry matter,
·068 lb. of digestible protein,
·043 lb. of fat, and
·82 lb of starch equivalent,

and thus adding ·87 lb. of dry matter, and as 4 lb. of green lucerne contain ·72 lb. of dry matter, it is suggested to deduct this amount of green lucerne, which contains, besides, ·11 lb. of digestible protein and ·35 lb. of starch equivalent.

——	Dry Matter.	Digestible Protein.	Digestible Fat.	Starch Equivalent.
3 lb. maize	2·61	·20	·13	2·45
5 lb. (½-gallon) skim milk	·50	·19	·01	·38
1 lb. green lucerne	·19	·03	..	·09
2 lb. swede turnips	·24	·01	..	·15
	3·54	·43	·14	3·07

This ration is nearly correct, though slightly low throughout, with the exception of digestible fat, which is of minor importance. This ration may be adjusted, if desired, by adding a small amount of any of the three fodders which are most convenient.

For instance—

——	Dry Matter.	Digestible Protein.	Digestible Fat.	Starch Equivalent.
(A)—				
Ration	3·54	·43	·14	3·07
2 lb. swedes	·24	·01	..	·15
	3·78	·44	·14	3·22
(B)—				
Ration	3·54	·43	·14	3·07
¼-lb. maize	·22	·02	·01	·20
	3·76	·45	·15	3·27
(C)—				
Ration	3·54	·43	·14	3·07
1 lb. green lucerne	·19	·03	..	·09
	3·73	·46	·14	3·16

For fattening purposes (A) might be slightly the best, as (B) is inclined to be wasteful, and (C) is slightly low in starch equivalent. There is, however, very little to choose between them on the score of actual nutrition.

KELLNER'S RATION FOR FEEDING OF PIGS.

TABLE SHOWING DAILY REQUIREMENTS IN FOOD (IN POUNDS) PER 1,000 lb. LIVE WEIGHT.

Age in Months.	Live Weight per Head.	Dry Matter in total Ration.	Digestible Substances		
			Protein.	Fat.	Starch equivalent.
	lb.	lb.	lb.	lb.	lb.
(*a*) Breeding Stock—					
2—3	44	44	6·2	1·0	33·8
3—5	88	36	4·0	0·8	27·3
5—6	120	32	3·0	0·5	23·2
6—9	175	28	2·3	0·3	20·2
9—12	265	25	1·7	0·2	15·8
(*b*) Fattening Stock—					
2—3	44	44	6·2	1·0	33·8
3—5	110	36	4·5	0·9	32·0
5—6	145	32	3·5	0·7	26·5
6—9	200	28	3·0	0·5	24·5
9—12	285	25	2·4	0·3	19·8

COMPOSITION OF FOODS.

Green Fodder.	Total Dry Matter in 100 lb.	Digestible Nutrients in 100 lb.				Starch equivalent per 100 lb.	Lbs. of Food to give.	
		Protein.	Crude Fat.	Carbohydrates or Nitrog. Free Extract.	Crude Fibre.		0·45 lb. of Protein.	3·2 lb. of Starch equivalent
Grasses—								
Barley (young) ..	19	1·5	0·3	6·4	3·1	9·6	30	33
Buffalo grass ..	22	1·2	0·4	9·0	2·9	12·0	37	27
Couch grass ..	26	2·4	0·3	7·3	5·3	12·5	19	26
Maize	29	1·2	0·4	9·8	6·4	14·5	37	22
Indian Cane ..	23	0·7	0·2	7·9	6·0	12·0	64	27
Oats (in green head)	21	1·0	0·4	7·5	3·6	11·0	45	29
**Panicum muticum* ..	27	1·4	0·3	7·3	6·0	12·0	32	27
Paspalum dilatatum	25	1·3	0·4	7·2	6·4	13·0	35	25
Prairie grass ..	23	2·1	0·6	6·1	4·5	10·5	21	31
Rhodes grass ..	29	1·0	0·4	8·6	7·7	15·0	45	21
Rye	24	1·4	0·5	7·0	4·9	11·3	32	28
*Sorghum	29	1·2	0·5	11·3	5·4	15·0	37	21
Sugar-cane (stalk) ..	29	1·0	0·5	14·0	6·5	18·5	45	17
Sugar-cane tops ..	27	1·1	0·6	8·9	6·7	14·0	41	23
Legumes—								
Beans (various) ..	15	1·5	0·5	4·1	1·6	7·1	30	45
Cowpea	20	1·9	0·5	6·2	2·9	9·5	24	34
Lucerne (flower) ..	24	1·5	0·4	5·7	3·5	8·4	30	38
Lucerne (young) ..	19	2·7	0·4	4·7	2·0	8·7	17	37
Peas	15	1·9	0·3	3·2	2·3	6·6	24	49
Peas (field)	17	1·6	0·3	3·7	3·0	6·8	28	47
Vetches (in flower)	17	1·4	0·3	4·9	2·3	7·5	32	43

* The Fodders marked contain hydrocyanic acid and prussic acid yielding glucosides, and must therefore be used with caution.

COMPOSITION OF FOODS—*continued.*

Green Fodders.	Total Dry Matter in 100 lb.	Digestible Nutrients in 100 lb.				Starch equivalent per 100 lb.	Lbs. of Food to give.	
		Protein.	Crude Fat.	Carbohydrates or Nitrog. Free Extract.	Crude Fibre.		0·45 lb. of Protein.	3·2 lb. of Starch equivalent.
Various—								
Cabbage	15	1·2	0·4	6·5	1·7	9·4	37	34
Mustard	15	1·3	0·2	4·9	1·5	7·2	35	43
Rape	14	1·3	0·5	3·9	1·9	7·0	35	46
*Sweet potato vines..	14	1·3	0·5	4·3	1·7	7·0	35	46
Roots, Tubers, &c.—								
Artichokes, Jerusalem	20	0·4	..	15·8	0·2	16·4	112	20
Beets (sugar) ..	25	0·3	..	20·3	0·5	15·8	150	20
Carrots	13	0·4	0·1	8·9	0·7	8·7	112	37
*Cassava	32	0·3	..	26·4	0·6	26·3	150	12
Mangels	12	0·1	..	8·3	0·3	6·3	450	51
Melon (pie)	6	0·1	..	3·9	0·1	4·0	450	80
Potatoes	25	0·1	..	18·9	..	19·0	450	17
Potatoes (sweet) ..	31	0·1	..	24·0	..	24·0	450	13
Swedes	12	0·3	..	7·6	0·9	7·5	150	43
Turnips	8	0·2	..	5·5	0·3	4·6	225	70
Pumpkin	8	0·3	0·2	4·5	0·2	4·0	150	80
†*Grains, Seeds, &c.*—								
Barley	86	6·1	1·9	62·4	1·3	72·0	7·4	4·4
Beans	86	19·3	1·2	44·1	4·1	66·6	2·3	4·8
Buckwheat	86	7·5	1·9	42·3	3·5	52·7	6·0	6·1
Corn (maize) ..	87	6·8	4·3	65·5	0·8	81·8	6·6	3·9
Millet	88	7·4	3·1	45·8	2·7	59·7	6·1	5·4
*Linseed	93	18·1	34·7	18·3	1·8	119·2	2·5	2·7
Oats	87	7·2	4·0	44·8	2·6	59·7	6·2	5·4
Peanut	93	24·6	46·7	10·2	2·4	146·5	1·8	2·2
Rice	87	5·5	0·2	75·8	0·7	82·0	8·2	3·9
Rye	87	8·7	1·1	63·9	1·0	71·3	5·2	4·5
Soja beans	90	26·2	15·8	20·8	1·7	83·9	1·7	3·8
Sorghum	85	4·1	2·5	57·8	1·7	67·9	11·0	4·7
Sunflower	93	11·1	30·7	10·3	9·4	96·0	4·0	3·3
Wheat	87	9·0	1·2	63·5	0·9	71·3	5·0	4·5
Various—								
Bran	89	10·0	2·7	44·3	3·6	48·5	4·5	6·6
Blood meal	91	68·0	2·0	..	..	67·7	0·7	4·7
Butter milk ..	10	3·8	1·1	4·0	..	9·2	11·8	35·0
Fish meal	90	40·1	11·0	..	..	64·2	1·1	5·0
Meat meal	90	63·6	12·5	..	..	89·9	0·7	3·6
Milk (whole) ..	12	3·3	3·4	4·6	..	14·7	13·6	21·8
Milk (separated) ..	10	3·8	0·2	4·7	..	7·6	11·8	42·0
Molasses	76	..	..	54·9	..	48·0	..	6·7
Pollard	89	10·0	3·2	49·8	2·2	68·2	4·5	4·7
Whey	7	0·9	0·8	4·9	..	6·4	50·0	50·0

* Contains hydrocyanic acid and prussic acid yielding glucosides, and must therefore be used with caution.

† Hard grains and seeds need soaking in water, until soft, before feeding to pigs.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, SEPTEMBER, 1921.

The seasonal increase in egg production for the month resulted in nearly every pen adding considerably to its tally. A noticeable feature for the month, and, in fact, during the whole of the test, is the freedom from broodiness. Several very good scores can be reported, viz., H. C. Towers's "F" bird produced the possible, 30 eggs; the following laid 29 eggs each:—W. Becker's "A," H. Fraser's "A," T. Fanning's "C", and E. Morris's "A." R. Burns had four of his six hens producing 28 eggs each, and T. Hindley two with the same number to their credit. The following deaths are reported:—T. Eyre's "C" hen and two birds in T. Hart's group pen of Black Orpingtons. J. W. Newton's "A" hen and Haden Poultry Farm's "A" are at present isolated. The following are the individual records and weights of eggs:—

Competitors.	Breed.	Sept.	Total.
LIGHT BREEDS.			
R. Gill	White Leghorns	137	765
*J. M. Manson	Do.	149	750
*W. and G. W. Hindes	Do.	146	748
H. C. Thomas	Do.	120	716
F. Birchall	Do.	127	715
*Geo. Trapp	Do.	142	714
Oakleigh Poultry Farm	Do.	133	707
*Mrs. R. Hodge	Do.	139	701
*H. C. Towers	Do.	143	685
*H. Fraser	Do.	140	682
*C. M. Pickering	Do.	127	674
R. C. Cole	Do.	130	671
W. A. Wilson	Do.	132	654
*J. W. Newton	Do.	123	647
*W. Becker	Do.	137	645
*T. Fanning	Do.	143	641
*C. Goos	Do.	123	621
Mrs. E. White	Do.	128	618
H. Stacey	Do.	131	618
Bathurst Poultry Farm	Do.	124	611
*E. Chester	Do.	124	609
M. F. Newberry	Do.	128	603
*R. C. J. Turner	Do.	121	601
W. Barron	Do.	129	598
*Thos. Taylor	Do.	126	593

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	Sept.	Total.
LIGHT BREEDS—*continued.*			
*Thos. Eyre	White Leghorns... ...	132	587
J. W. Short	Do.	130	586
*S. L. Grenier	Do.	132	585
Mrs. E. Z. Cutcliffe	Do.	118	582
*B. Chester	Do.	134	581
*G. Williams	Do.	131	580
O. C. Goos	Do.	110	580
E. Stephenson	Do.	113	574
*Mrs. L. Anderson	Do.	127	570
*E. A. Smith	Do.	135	565
Linquenda Poultry Farm	Do.	128	555
*Haden Poultry Farm	Do.	118	552
*W. and G. W. Hindes	Brown Leghorns... ...	118	550
*H. P. Clarke	White Leghorns ...	129	516
W. M. Glover	Do.	112	508
Crampton Poultry Farm	Do.	116	474
HEAVY BREEDS.			
T. Fanning	Black Orpingtons ...	145	812
*J. Ferguson	Chinese Langshans ...	132	744
Rev. A. McAllister	Black Orpingtons ...	141	740
Jas. Potter	Do.	104	738
*T. Hindley	Do.	148	736
*R. Burns	Do.	161	729
*A. E. Walters	Do.	140	715
W. Becker	Langshans	139	708
*Parisian Poultry Farm...	Black Orpingtons ...	149	702
Jas. Every	Langshans	124	699
G. Muir	Black Orpingtons ...	134	697
Jas. Ryan	Rhode Island Reds ...	117	689
*C. C. Dennis	Black Orpingtons ...	134	684
*E. F. Dennis	Do.	129	653
*J. Cornwell	Do.	134	644
*E. Morris	Do.	133	638
*E. Stephenson	Do.	125	622
*R. Holmes	Do.	131	614
G. Cumming	Do.	112	579
*N. A. Singer	Do.	141	572
*H. C. Chaille	Do.	125	569
J. W. Newton	Do.	117	552
*A. Shanks	Do.	137	550
*J. E. Smith	Do.	118	549
*Mrs. G. Kettle	Do.	108	544
*E. Oakes	Do.	130	497
F. Harrington	Rhode Island Reds ...	129	475
T. C. Hart	Do.	110	395
Total	...	8,940	43.378

* Indicates that the pen is being single tested.

RESULTS OF SINGLE TEST PENS.

Competitors.	A.	B.	C	D.	E.	F.	Total.
LIGHT BREEDS.							
J. M. Manson	115	130	135	117	139	114	750
W. and G. W. Hindes (W.L.) ..	135	114	124	138	135	102	748
Geo. Trapp	120	111	119	117	129	118	714
Mrs. R. Hodge	113	127	129	120	126	86	701
H. C. Towers	119	101	117	95	113	140	685
H. Fraser	130	98	119	108	118	109	682
C. M. Pickering	123	117	108	97	130	99	674
J. W. Newton	113	127	126	104	85	92	647
W. Becker	127	123	95	98	135	67	645
T. Fanning	121	101	112	99	99	109	641
C. Goos	107	125	76	77	90	146	621
E. Chester	108	111	101	97	95	97	609
R. C. J. Turner	104	95	95	87	108	112	601
Thos. Taylor	96	112	97	76	86	126	593
Thos. Eyre	98	101	62	109	113	104	587
S. L. Grenier	102	122	72	101	97	91	585
B. Chester	93	93	116	88	111	80	581
G. Williams	138	106	73	83	89	91	580
Mrs. L. Anderson	94	109	97	86	105	79	570
E. A. Smith	126	96	97	92	88	66	565
Haden Poultry Farm	70	82	98	90	95	108	552
W. and G. W. Hindes (B.L.) ..	77	83	77	104	89	120	550
H. P. Clarke	124	75	87	60	87	83	516
HEAVY BREEDS.							
J. Ferguson	121	118	111	138	127	129	744
T. Hindley	133	123	127	99	133	121	736
R. Burns	70	112	153	103	143	148	729
A. E. Walters	130	125	111	114	113	122	715
Parisian Poultry Farm	110	118	118	150	83	123	702
C. C. Dennis	121	107	96	125	116	119	684
E. F. Dennis	90	117	107	107	107	125	653
J. Cornwell	105	87	113	126	104	109	644
E. Morris	115	114	69	125	105	110	638
E. Stephenson	116	101	103	100	87	115	622
R. Holmes	86	98	102	115	132	81	614
N. A. Singer	95	82	93	96	87	119	572
H. C. Chaille	67	106	97	124	106	69	569
A. Shanks	64	94	85	100	101	106	550
J. E. Smith	122	127	97	76	66	61	549
Mrs. G. Kettle	93	106	118	53	77	98	544
E. Oakes	54	104	85	111	77	66	497

WEIGHT OF EGGS, SINGLE HEN PENS.

—	A.	B.	C.	D.	E.	F.	Average
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
LIGHT BREEDS.							
S. L. Grenier	2	2	2 1/8	2	1 7/8	2	2
W. and G. W. Hindes (W. L.) ..	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8
Mrs. L. Anderson	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
G. Williams	2 1/4	2	2 1/8	2	1 1/4	2	2 1/8
Mrs. R. Hodge	2	2 1/8	2	2	2	2	2
J. M. Manson	2 1/8	1 3/4	1 5/8	1 7/8	1 7/8	1 7/8	1 7/8
W. Becker	1 7/8	2 1/8	2	2 1/8	2	2	2
C. Goos	2	2	1 3/4	2 1/4	2	2	2
J. D. Newton	2	2 1/8	1 7/8	1 7/8	2	2 1/8	2

WEIGHT OF EGGS, SINGLE HEN PENS—*continued.*

——	A.	B.	C.	D.	E.	F.	Average.
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
LIGHT BREEDS—*continued*							
T. Taylor	2 1/8	2	2 1/8	2 3/8	2	1 3/4	2 1/8
Haden Poultry Farm	2	2	2	2	2 1/8	2	2
H. P. Clarke	2	2 1/8	2	2 1/8	2	2	2
T. Eyre	2	1 7/8	1 7/8	1 7/8	1 7/8	1 3/4	1 7/8
H. Fraser	1 7/8	2	1 7/8	2	1 7/8	2	1 7/8
Geo. Trapp	2	2	2	2	2	2	2
T. Fanning	2	2	2 1/8	2 1/8	2 1/8	2	2 1/8
R. C. J. Turner	2 1/4	2 1/4	2 1/8	2 1/8	2	2	2 1/8
W. and G. W. Hindes (B. L.)	2	1 7/8	1 7/8	2	1 7/8	1 7/8	1 7/8
E. Chester	2	2	1 7/8	1 7/8	2 1/8	2	2
H. C. Towers	1 7/8	2	1 7/8	2	2	2	2
B. Chester	1 7/8	1 7/8	2	2	2 1/8	2 1/8	2
E. A. Smith	2 1/8	2 1/8	2 1/8	2 1/8	2 1/4	2 1/4	2 1/8
C. M. Pickering	2 1/4	2	1 7/8	2 1/4	2	2 1/4	2 1/8
HEAVY BREEDS.							
T. Hindley	1 5/8	1 7/8	2	1 7/8	1 7/8	2	1 7/8
R. Burns	2 3/8	1 7/8	2 3/8	2 1/4	2 1/8	1 7/8	2 1/8
E. F. Dennis	1 7/8	2	2 1/8	2 1/8	2 1/8	2	2
A. E. Walters	1 7/8	2 1/8	2	2 1/8	1 7/8	2	2
Mrs. H. H. Kettle	2 1/8	2 1/8	1 7/8	2	2 1/8	2	2
Parisian P. Farm	2	2	1 7/8	1 3/4	2	2	1 7/8
J. E. Ferguson	1 7/8	2 1/8	2 1/8	1 7/8	2	2	2
R. Holmes	1 3/4	2 1/4	2	1 3/4	1 7/8	2	1 7/8
A. Shanks	2 1/4	2 1/8	2 1/8	2 1/8	2	2 1/8	2 1/8
J. E. Smith	1 3/4	1 5/8	1 7/8	2	2 1/8	2 1/4	1 7/8
E. Stephenson	2	2 1/8	1 7/8	2 1/8	1 7/8	2	2
N. A. Singer	2 1/8	2 1/8	2 1/8	2	2	2 1/8	2 1/8
E. Morris	1 7/8	2 1/8	2 1/8	1 7/8	2	1 7/8	2
H. Chaille	2	2	2	2 1/8	1 3/4	2 1/4	2 1/8
E. Oakes	2	1 7/8	2	1 7/8	2 1/4	2 1/8	2
C. C. Dennis	2	1 7/8	1 3/4	1 7/8	1 7/8	1 7/8	1 7/8
J. A. Cornwell	2 1/8	2	2	1 7/8	2	1 7/8	2

GROUP PENS.

——	Average.	——	Average.
LIGHT BREEDS.			
	Oz.		Oz.
W. M. Glover	2 1/4	H. C. Thomas	1 7/8
H. Stacey	1 7/8	Mrs. E. Cutcliffe	2
O. Goos	2 1/8	J. Short	2 1/8
R. Gill	1 7/8	Linquenda P. Farm	1 7/8
Oakleigh P. Farm	1 7/8	F. Burchall	2
E. Stephenson	2	Brampton P. Farm	2 1/8
R. Cole	2	Bathurst P. Farm	1 7/8
Mrs. E. White	2	M. F. Newberry	2
W. A. Wilson	2	W. Barron	1 7/8
HEAVY BREEDS.			
W. Becker	1 7/8	G. Cummings	2
J. Ryan	1 7/8	G. Muir	1 7/8
T. Hart	2	T. Fanning	2 1/8
Rev. A. McAllister	2	J. Newton	2
F. Harrington	2	J. Every	1 7/8
J. Potter	1 3/4		

CUTHBERT POTTS,
Principal.

The Orchard.

THE FRUITGROWING INDUSTRY.

By ALBERT H. BENSON, M.R.A.C.

I.

(The first of a series of articles relating to marketing methods and problems, containing suggestions for the consideration of all engaged in fruit production.)

Fruitgrowers, not only in Queensland, but in the whole of the Commonwealth, are beginning to realise the unsatisfactory condition into which the selling end of their industry has been allowed to drift, and to recognise that the only way to place it upon an improved basis is to radically and drastically alter the methods employed for the disposal, distribution, and utilisation of their products.

The difficulty confronting growers to-day is not how to grow fruit, but how and where to sell it. This difficulty is not a new one. It is one that has, year after year, been discussed at local, interstate, and Australian fruit conferences since the first interstate assembly at Mildura in May, 1894. At the Australian conference at Sydney in August last a discussion on marketing problems was a leading item on the business-sheet. Many suggested solutions have been brought forward for discussion from time to time, and these have been wide enough to cover—

(1.) Co-operation among growers to open up oversea markets;

(2.) Obtaining facilities for transport thereto;

(3.) Improved means of interstate transport;

(4.) Institution of more efficient marketing organisation;

(5.) Popularising the use of fruit; and

(6) The employment of every other means of creating a stronger demand within the Commonwealth.

These ideas are all sound and practical, as are also other proposals in respect to the conservation and utilisation of surplus supplies.

Unfortunately, however, although growers have repeatedly affirmed the desirability of initiating reforms whenever they met to discuss the position and condition of their industry, they have, apparently, remained content with merely carrying resolutions, instead of translating good will to strong action. The matters involved have thus been carried forward from conference to conference, and so repeated decisions have, consequently, through failure to sustain the energy of the initial effort, remained inoperative or ineffective. In this way conferences fail to accomplish much of their real purpose. Unless resolutions are made effective and co-operative effort becomes more than merely a platitudinous term and more of an actual fact, the industry cannot attain the degree of importance in the commercial world that it obviously merits. It is difficult to account for this inertia, but it is probably due to the fact that so very little real co-operation exists among fruitgrowers, who, like their confrères in other branches of agriculture, are often very conservative and suspicious of any innovation. This spirit seems to continue to exist in spite of the knowledge that the value of co-ordinated and co-operative effort has been incontestably proved as really the only means by which primary producers can place their industry on a sound business basis.

At the present time the most serious difficulty facing fruit producers is their inability to place their products, in one form or another, at a price that will provide a fair thing for both producer and consumer. This failure in properly organised distribution is a very serious bar to the extension of the industry. It also affects the general health of the community, for fruit is held to be a dietary essential. This, in a country like Australia, which is capable of producing practically every variety of cultivated fruit, should not be. Even in our furthest back country, fruit should, under a proper system of distribution, be readily obtainable at reasonable rates.

The question of distribution is, therefore, of vital importance to every grower and consumer, and the time for altering and improving present marketing methods is *now*. Unless obvious business difficulties can be quickly overcome, I feel certain that the fruit industry will meet with a serious check, and many growers will be hard hit. I have no wish to be pessimistic, nor do I think there is any immediate

necessity to be so, for on every side are signs of a general awakening. Still, I think it right to sound a timely note of warning, as, in my opinion, we cannot afford to waste any more time, but must make a determined effort immediately to grapple with the problems awaiting solution. Under existing conditions we are quite unable to cope with fruit-marketing difficulties at certain periods. We have had gluts, and we shall have them again, and the lessons they teach are obvious. At the time of writing, strawberries and bananas are returning little, if any, profit to the grower, and locally-grown lemons and Seville oranges are practically unsaleable. Over-supply of limited markets is plainly disastrous. These facts are known to all who take an intelligent interest in affairs, and they are enough to show the immediate necessity of vigorous business action.

The increased orchard acreage in all States adds to our difficulties and increases the urgency of organisation to meet them. Increased production will, naturally, intensify the market congestion that occurs at periods corresponding with the ripening of certain fruits, the nature of which compels their immediate disposal. This big increase in the area under fruit in all the States is mainly due to two factors—the policy of water conservation and the consequent utilisation of irrigable areas, and to the settlement of large numbers of returned soldiers. No provision has yet been made for the increased production that naturally follows extended settlement. Hence the necessity for market organisation and the improvement of every facility for satisfactory selling becomes every day more urgent. The question, therefore, naturally arises—what can be done to save the situation?

Before this question can be answered, it is necessary to determine what markets are accessible for both fresh and preserved products. In Queensland we want outlets for bananas, pineapples, papaws, mangoes, custard apples, strawberries, citrus fruits, and other products of the coastal districts, and also for the deciduous fruits of the granite belt.

In tropical products we have an advantage over the other States excepting a small region on the north-east coast of New South Wales. Consequently, there is practically no opposition, and that competition is confined almost entirely to bananas. Citrus fruits are, however, grown in all the other States, Tasmania excepted, and our only advantage rests in the fact that our citrus products ripen earlier; further, our mandarins are so superior in quality to the southern-grown that we can well hold our own on southern markets.

Though we have virtually a monopoly in the supply of tropical fruits, our system of advertisement and methods of distribution are so faulty that many Queensland fruits are quite unknown in other States. Lack of organisation, and, therefore, publicity on the part of our growers, is largely responsible for this state of affairs. Until recently no attempt had been made to reach markets other than those of the State capitals, and so familiarise southern consumers outside the main centres with Queensland fruits. Organisation, stabilisation, and judicious advertisement are essentials of successful marketing, and each can be covered by sound co-operative effort. Bananas, pines, and citrus fruits can be supplied to every railway station in the Commonwealth, provided packing, transport, and distribution are properly arranged. The more perishable products can be sent to many markets where they are at present unknown, under the same conditions.

These ideas are not theoretical, and all, judging by the great success of co-operative marketing systems operating in other countries, are well within practical range. Producers' organisations in the United States are at present distributing tropical as well as temperate fruits all over the Union. Incidentally, the results of forty years of American enterprise and experience are at our disposal when seeking a satisfactory solution of our own problems. What can be done there can be done here. The inauguration of the southern fruit trains by the Southern Queensland Fruitgrowers' Association is only a beginning of what may be accomplished, and is in itself evidence of the value of united and well-organised effort. When this trade is extended and distribution widened beyond the capital cities, its present limit, I feel certain that, in respect to our tropical and sub-tropical fruits, we shall have a market within the Commonwealth for the whole of our production.

For example, take bananas. At present the bulk of our exports are being railed to only the capital cities, where they are handled by wholesale distributors, who have, so far, made little, if any, attempt to supply many smaller markets, with the result that there are many centres all over Australia in which Queensland fruits are unknown, or unobtainable. If a demand is created, it is only supplied at exorbitant prices that make fruit, that should be looked upon as a necessity, a luxury for which the market is extremely restricted. It is not necessary even to go outside our own State to observe accessible yet unexploited markets. Go into the western country and note the price at which bananas are retailed—there is no need to leave the railway—and then say we have an unplaceable surplus! Get the fruit on to the

Horticulture.

FLOWERING TREES OF THE BRISBANE BOTANIC GARDENS.

BUTEA FRONDOSA.

NATURAL ORDER LEGUMINOSÆ.

BY E. W. BICK, Curator, Brisbane Botanic Gardens.

Derivation.—*Butea,* named in honour of the Earl of Bute; *frondosa,* from leafy, umbrageous.

Description (from Roxburgh's "Plants of Coromandel," 1795).—An erect tree reaching a height of from 40 to 50 ft. Trunk irregular, generally a little crooked, covered with ash-coloured, spongy, thick, slightly scabrous bark, the middle layer of which contains a red juice. From natural fissures and wounds made in the bark during the hot weather there exudes a beautiful juice that soon hardens into a ruby-coloured, brittle, astringent gum; but it soon loses its beautiful colour if exposed to the air. To preserve the colour the gum must be gathered as soon as it becomes hard, and kept closely corked in a bottle; pure water dissolves it, and the solution is of a deep red colour, used in dyeing.

Branches very irregular, bent in various directions, young shoots downy, leaves alternate, in threes, from 8 to 16 in. long, leaflets emarginated, or rounded at the apex, leathery; above shining and fairly smooth, below slightly hoary; entire, from 5 to 7 in. long, and from 3 to 4½ in. broad. Common petiole round, swollen at base, when young downy, racemes terminal, axillary, and from tuberosities over the naked wooded branches, rigid, and covered with a soft dark-greenish purple-coloured down.

Flowers.—Papilionaceous, pendulous, numerous, pedicelled, large, their ground colour a beautiful deep red shaded with orange and silver-coloured down that gives them a most beautiful "Indian red" appearance. Calyx campanulate, leathery, two-lipped, upper lip large, under lip three-toothed, covered with the same dark greenish-purple down as racemes. Petals bright orange red, thickly clothed on outside with silvery tomentum, reflected, pointed, upper one slightly over 1 in. in width, keel semi-circular, beaked, filaments one and nine in a regular semicircle, anthers equal, linear, erect, style ascending, a little longer than filaments, stigma small; individual flowers are about 2½ in. in length.

In addition to the gum already mentioned, the flowers, either fresh or dry, are used in India for dyeing purposes; they are prepared by infusion, and dye cotton cloth a most beautiful bright yellow, more or less deep according to strength of infusion. A little alkali added changes the colour to a deep reddish orange, but the least acid changes it to a yellow or lemon.

Pod.—Large, pendulous, all but the apex where the seed is lodged, downy, about 6 in. long by 2 in. broad, never opens by itself; seed one, lodged at point of pod, oval, much compresseed, smooth brown, about 1 to 1½ in. long and 1 broad.

Habitat.—Plains from the Himalayas to Ceylon and Burmah, ascending to 4,000 ft. in the north-west.

This beautiful flowering tree that forms such a bright-coloured feature of the Indian landscape during March and April flowers in Brisbane in November, and the fine specimen on corner of lawn below the bandstand in the Botanic Gardens attracts the attention of visitors by its vivid mass of colour when in flower, it being very conspicuous owing to the fact that the foliage falls off just previous to flowering.

Propagation.—Unfortunately, owing probably to being rather far south for this magnificent tree to be properly at home, although it flowers well each season, very few pods are produced, and only occasionally are seeds obtained.

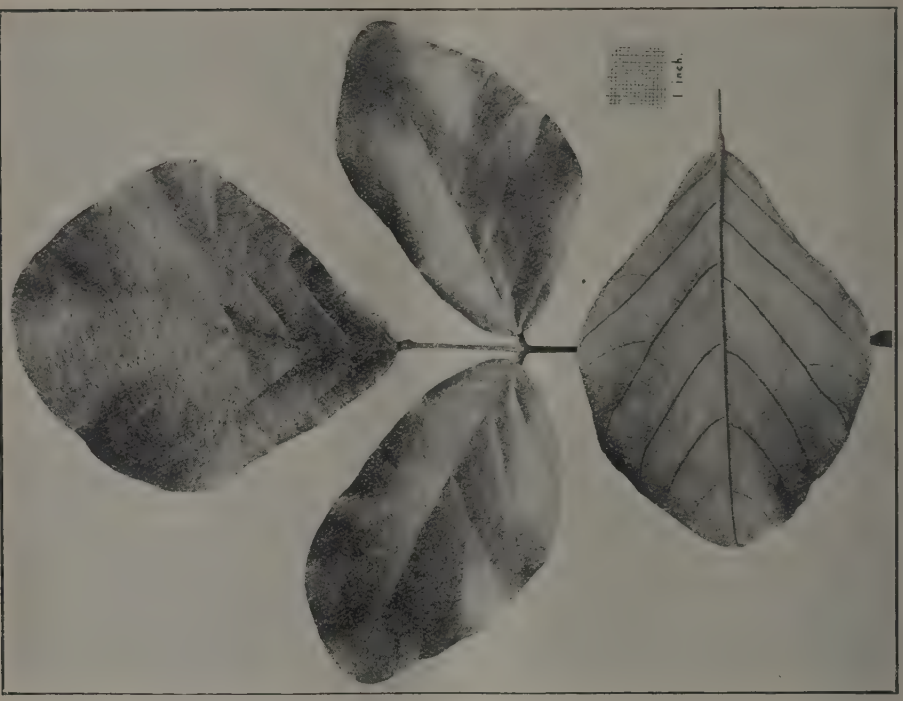

PLATE 70.—*Butea frondosa*: LEAVES.

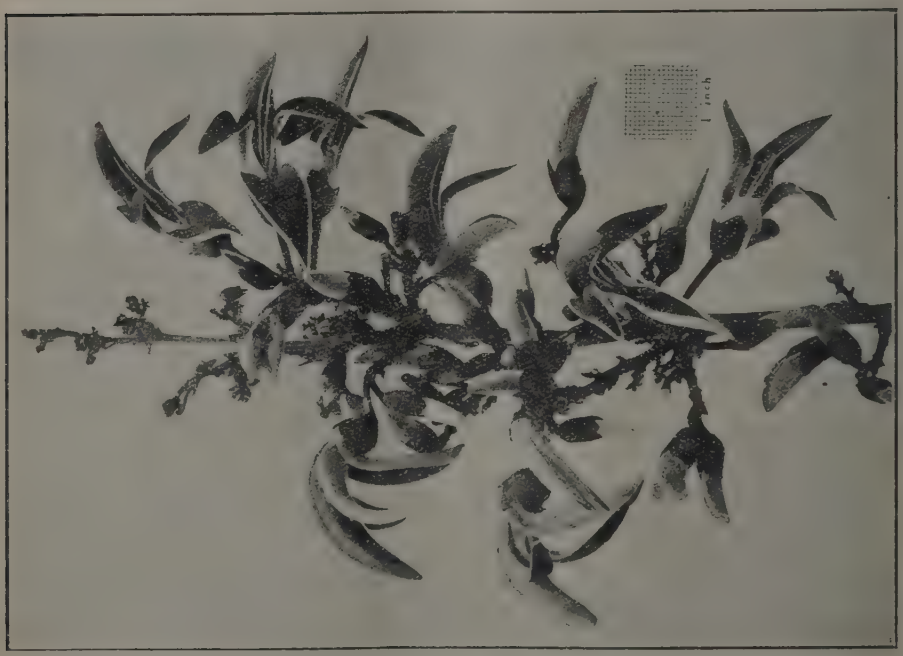

PLATE 69.—*Butea frondosa*: FLOWER STEM.

Viticulture.

DOWNY MILDEW.

In accordance with a request made by vignerons of districts that suffered by the incursion of downy mildew last year, a Regulation under "*The Diseases in Plants Act of* 1916" has been issued by His Excellency the Governor in Council providing for the treatment of all grape vines affected with this disease. The prescribed treatment provides for at least three sprayings and such further sprayings as may be deemed necessary by a fruit inspector. It is only compulsorily applied when the disease has made its appearance in a vineyard.

Downy mildew can be prevented by systematically spraying the vines before it appears. Growers are urged to spray for their own protection. In respect to sprayings definitely provided for by the Regulation, it is questionable whether the first spraying, which is given just before the buds burst, is actually needed, but it is certainly of great value in the case of anthracnose or "black spot," which is a very serious and common fungoid disease of the vine. It is often found attacking the same plant as downy mildew, and should not be neglected. The second spraying before the vines blossom, that is, when they have grown from 10 to 18 in., protects the new growth from infestation; and the third spraying, given when the blossom has set, protects the foliage produced after the second application.

If the weather conditions are very favourable for the development of the fungus causing downy mildew, viz., warm, moist, or foggy, it may be necessary to give an extra spraying, or even two, between the second and third sprayings, for which the Regulation referred to makes provision. These extra applications may be made even during the blossoming period as it is better to run the risk of losing a few berries than the loss of the whole crop. The number of sprayings necessary after the fruit has set will depend entirely on the weather. If it is warm and dry further applications may not be necessary, but if moist and muggy, spraying must be continued, otherwise the new growth will suffer and the bunches will become affected.

The fungus that causes downy mildew is not merely a surface growth, but it extends right through the vine and is carried over from season to season by the spores that remain dormant in the old leaves during the winter and become active in the spring—probably about the end of September or early in October in the coastal districts, and a little later in inland regions. These spores are carried by the wind, and, if they lodge on the upper side of a moist vine leaf, they begin growth at once, provided the atmospheric conditions are favourable and the leaf has not been protected by spraying with a germ-destroying specific.

The first sign of a disease is a brownish spot on the upper surface of the leaf that looks as though a drop of oil had been deposited upon it. This is known as the "oil-spot" stage. In the course of a day or so a white downy growth appears on the under side of the leaf exactly opposite the "oil spot," and it is from this development that the disease takes its name. This downy growth produces countless spores, which are distributed broadcast by the wind. Each of these spores is capable of reproducing the disease if it comes in contact with a vine leaf under conditions favourable to its development.

When neglected, downy mildew spreads with alarming rapidity when the weather is favourable, and the entire crop of a district may be destroyed in a very short time; hence the great importance of taking precautionary measures.

The plate illustrating these notes gives a good idea of the disease in the "downy" stage, and should enable anyone to recognise it at once. In the later stage of the disease the leaves turn brown, dry up, and fall off, the fruit is destroyed, and, in severe cases all new wood growth is killed, so that not only is there no crop for that season but none also for the following year.

REMEDY.

The remedy for this disease is to give the leaves of the vine a protective covering before the resting spores become active in spring, and to keep them protected as long as risk to the crop exists. The best spray is Bordeaux mixture, 4-4-40; 4 lb. bluestone, 4 lb. quicklime, and 40 gals. water, made according to the directions given in departmental publications dealing with the destruction of fruit and vegetable pests. The spraying material must be neutral; that is to say, it must not contain any free sulphate of copper (bluestone), and this is determined by adding a drop of a solution of fero-cyanide of potassium to a small quantity of the mixture. If there is no

discolouration, the mixture is neutral, but if there is a brown ring round the drop of fero-cyanide, free bluestone is present and more lime must be added. If vignerons have any difficulty of obtaining fero-cyanide of potassium, a small quantity of the solution for testing purposes can be obtained from the Agricultural Chemist.

PLATE 71.—DOWNY MILDEW ON VINE LEAF.

The Regulation referred to is as follows, and must be complied with by every person whose vines are affected by downy mildew:—

"Every occupier, or if there is no occupier the owner, of any land whereon plants of the genus Vitis (grape vine) are grown shall cause all such plants as may be affected with the disease of downy mildew (Peronosporeæ) to be sprayed with Bordeaux or Burgundy mixture to the satisfaction of an inspector, first when the buds are swelling and prior to their opening, and subsequently once before the vines come into flower, and again immediately the fruit has set. Should downy mildew make its appearance subsequently, further sprayings shall be given as and when an inspector shall direct."

Tropical Industries.

SUGAR FIELD REPORTS.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report (dated 21st October, 1921) from the Northern Field Assistant, Mr. E. H. Osborn:—

"Early in September the Innisfail district, comprising Goondi, Mourilyan, and South Johnstone mills, were visited.

"The town of Innisfail itself was, as usual, very busy, and accommodation very hard to obtain.

"*Goondi.*—A great deal of rain has fallen on this area, delaying planting operations considerably, and also preventing the recently cut ratoons from getting away as they should. Under these conditions, prevailing up to the middle of the month, the task of keeping the mill supplied with sufficient cane was anything but an easy one. About that time, however, a fine spell had set in, and all over the district the farmers were busy. As far as could be ascertained, the several mills in the district will all probably cut short of their earlier estimates, the wet weather being the principal cause, although rats, borers, and, in places, a few grubby patches help to account for the shortage. The borers are very bad this year throughout the district, both plant cane and ratoons suffering. The rat pest is, of course, more apparent on low-lying river and creek banks.

"The principal cane grown is Badila, with some small quantities of H.Q.426, and 7R.428. The demand for new varieties from the South Johnstone Experiment Station has been very keen, and a good deal of E.K.1, E.K.28, H.109, Tableland Badila, Hybrid No. 1, Q.903, Q.813, Q.855, and various other new canes have been supplied. At the Experiment Station the chemist in charge has been kept very busy supplying plants to local centres, and also to the Herbert River, Babinda, and Cairns. Adjoining the Goondi area a good deal of liming has been carried out. I am told that good-quality coral sand is being sold at £3 per ton locally, whilst burnt coral lime is worth £4 per ton. Some farmers are manuring heavily, and quite a number of tractors are in use in this prosperous centre.

"*Mourilyan Mill.*—In this area conditions are practically similar to Goondi. As regards lime, however, they are not so well situated as the Goondi growers, as the extra cost on the Mourilyan side of the river makes it very expensive to handle. I am informed that some 500 tons of manure, consisting principally of basic super, Shirley's Three Sevens, meatworks, dried blood, and sulphate of ammonia, have been already ordered on account of next season's crops.

"*Maria Creek Soldiers' Settlement.*—This area will send its cane in to the South Johnstone Central Mill. A considerable improvement was noted since my previous visit, and evidently a vigorous development policy has been carried out by the Supervisor (Mr. Martin).

"The ex-soldiers are now very busy clearing and burning off new blocks, taking advantage of some fine weather to get through as much work as possible. There are at present about fifty settlers in residence, some fifteen of them having their wives with them. New men are continually arriving, and the place promises to be a very busy one in the near future. The cane seen is backward, but looks fairly healthy and very green.

"The cane area is now as follows:—

Planted 1920	187 acres
Planted 1921	100 acres
To plant 1921	370 acres
To plant 1922	120 acres
	777 acres

giving a total of nearly 800 acres for 1923.

"The Railway Department is pushing the line connection ahead as rapidly as possible, and about the end of November should see the settlement linked up with the South Johnstone Central Mill and Innisfail. The cane now being grown is Badila, but Mr. Martin has also planted out a small plot of new canes from the experiment station.

"*South Johnstone Central Mill.*—This area also comprises Japoon and Liverpool Creek lands. The mill was very busy trying to make up the leeway caused by the late strike, and was getting away with a full supply of cane in good style. Although much valuable time was lost through the strike, both growers and men seem to think that, individually, it has done a certain amount of good, as the present relations are much more satisfactory. As mentioned earlier in these notes, the expected tonnage to be harvested will probably fall below the earlier estimates. Rats and borers have caused considerable damage in the district, but, luckily, the damage from grubs is mainly confined to the 17-mile. Badila represents nearly 95 per cent. of the cane now growing here, but full advantage is being taken of the proximity of the experiment station to obtain plants from there. Not many tractors are in use in the area. Mr. Sugden is now trying the effects of a dressing of lime earth upon one of his cane paddocks.

"*Japoon and Liverpool Creek.*—These areas have also suffered from wet weather, the cane not throwing the growth that it should. In places the trash clings very tightly to the cane, and top shoots are very noticeable. Arrowing here is also as prevalent as in the surrounding areas.

"Considering the weather, it is pleasing to know that the c.c.s. of the cane is very steadily improving. A lot of ploughing and planting is in progress.

"Taking the Innisfail district throughout, it is a very busy one. At South Johnstone, especially, everything is very active, and all hands are doing their best to make up for the enforced idleness of the late strike.

"*Babinda.*—Continuous rain has hindered planting operations. Cane planted later on was looking very fair, whilst the ratoons, although comparing very favourably with those recently visited in other areas, had not the vigorous growth usually so characteristic of this district. Also, although a good deal of 'arrowing' was present, it was not so noticeable as elsewhere. Caterpillars had also attacked and knocked back a lot of the young cane. Badila is by far the main cane grown here, but several growers are trying out new canes from the South Johnstone station.

"Owing to the wet, harvesting operations are very strenuous, and the supply of cane is light in consequence.

"So far the mill officials hope to finish crushing shortly before Christmas, and all hands are fervently hoping for a spell of really fine weather with this in view. As regards pests, the area seen so far is fairly free.

"Borers are fairly active in several places, but the rat pest is not serious."

The Southern Field Assistant, Mr. J. C. Murray, reports, under date 21st October, 1921, as follows:—

"In the course of September, Childers, Nambour, and Bundaberg were inspected. A visit was also made to Beenleigh in connection with the judging of the cane exhibits at the local show.

"*Childers.*—This district is looking very prosperous at present. The cane is cutting well, and the field workers are giving satisfaction. Density is good, and is gradually improving. The most satisfactory variety in this latter respect is Mauritius 1900 Seedling. Other varieties are doing well, farmers having no complaints to make against the returns of D.1135, Black Innis, Petit Senneville, and Q.813.

"The Mauritius cane, Petit Senneville, is not widely grown, but where it is raised the planters like the cane. It is fairly resistant to disease attack, produces good crops, and strikes usually with a low percentage of misses. A characteristic of this cane is that it occasionally shows more than one eye growing near the node.

"Intensive cultural methods are being employed. Many growers contend, and with a certain degree of accuracy, too, that, owing to the rapidity with which unfertilised volcanic soils responded after the rains in mid-autumn, artificial treatment is, on the whole, unnecessary as yet. The red soils are, however, deficient in humus, and while growers may not get positive results immediately following a vegetable manuring, the results of green cropping will prove satisfactory in the end.

"There are not many complaints of disease. Some canes are showing the effect of 'rust' and 'striped disease,' but the areas affected are limited. 'Gumming,' in isolated patches, is slightly depreciating the value of the cane.

"While visiting the Beenleigh Show I met a considerable number of sugar-growers and farmers who are going in for cane. Arrowroot has practically ceased to be a paying proposition, owing to the slump in the market, and the present stability of the sugar industry is attracting the attention of arrowroot planters.

"Of the canes exhibited at the show, none of the later distributed varieties was noticeable, but the exhibit was very fine on the whole, especially the Demerara 1135. However, the growers are in possession now of several new canes sent out by the Bundaberg Experiment Station, and perhaps next year some of these may be shown.

"While in Beenleigh I was much impressed by the general efficiency of the community, and by the standard of the agricultural exhibits generally.

"At Nambour the cane harvest is proceeding satisfactorily. The cane is cutting with good weight per acre, and the c.c.s. tests are well up to the average. Of the varieties being milled from immediately round Nambour, D.1135, H.Q.285, and M.1900 Seedling are making the best showing. Other varieties grown on a lesser scale are giving satisfaction, as also are Reintroduced D.1135, Q.813, Petit Senneville, N.G.16, and Malabar.

"The Nambour area is at present remarkably free from disease and natural enemies to the cane, with, perhaps, the exception of water-rats. The latter come up from the creek, and loss on a minor scale occurs, although the farmers use every effort to check them.

"Up at Mapleton there is considerable activity. Growers have some good cane land free from frosts, with an abundant rainfall. 1900 Seedling is a variety that should do well on these altitudes. D.1135 is at present the staple variety. The growers are recommended to try Q.813, Reintroduced D.1135, Q.970, Q.1098, E.K.1, and Shahjahanpur No. 10. These varieties should do well on the range.

"Conditions in the Bundaberg district are satisfactory. Very few, if any, industrial disputes have occurred, and the mills are smoothly working. Sugar content of the cane is improving as the season advances; also tonnage per acre. The standard varieties are giving good results this crushing, especially 1900 Seedling.

"One grower on the Woongarra area got from second ratoons of this cane 35 tons per acre, with an average c.c.s. of 14.

"Good strikes of young plant cane are in evidence, and the growers have noxious weeds well under control."

ENTOMOLOGICAL NOTES.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report, dated 25th October, 1921, from the Entomologist, Mr. E. Jarvis:—

"The weather conditions during the period 27th August to 23rd September have been favourable to the development of our cane beetle, *Lepidoderma albohirtum*, all of which are at present in the pupal state, awaiting those profound changes which will eventually allow them to wing their way to the forest trees, and incidentally into the canefields.

"At our laboratory, the rainfall for this month has been 1.45 in., and the average temperature in the shade 70.5 deg. F.

"NOTES ON MUSCARDINE FUNGUS.

"Readings of the thermometer between the dates 13th to 31st August were particularly interesting, since they helped to illuminate certain matters relating to spore germination of the parasitic fungus *Metarrhizium anisopliæ*. During this period of nineteen days, while the mean shade temperature was 68.6 deg. F., no less than twenty-two third-stage larvæ of albohirtum were killed by this fungus.

"These grubs, which had been paralysed by scoliid wasps (*Campsomeris tasmaniensis* Sauss.) had lain in shallow earthen cells for about two weeks prior to the first fungus attack, so presumably must have become infected by this vegetable parasite in the field before encountering the digger-wasps. Germination of the spores, however, did not take place until the abovementioned temperature prevailed, although during this fortnight preceding the first outbreak of the fungus fifty or more paralysed grubs had been lying in our breeding-trays under exactly similar conditions of handling. The only apparent difference was that the maximum and minimum shade temperatures during that two weeks were 75.5 deg. and 50.8 deg. F., respectively.

"Thus, it appears likely that this slight variation (an additional 2 deg. in the average maximum, and 8.7 deg. in the minimum temperatures) is sufficient to cause germination of the spores of metarrhizium.

"It may be mentioned here that our highest mortality occurred during a mean shade temperature of 67.8 deg. F.

"The above observations will, it is hoped, prove helpful during future experimentation in connection with control work against our various cane pests.

"BREEDING DIGGER-WASPS.

"Four years ago the writer studied the life-history and habits of two native species of *Scoliidæ* that are parasitic on the grubs of our cane-beetles, and succeeded in breeding from the eggs three successive broods of wasps in the one season. The winter brood, however, was not followed up at the time, so is being investigated now, and some further interesting data has been secured.

"Cool winter conditions, as might have been expected, somewhat retard development of the various stages of these parasites. The eggs, for instance, which during summer weather hatch in three days, took from seven to ten days. or even longer; and the period occupied by the combined egg and maggot stages varied from eighteen to twenty-four days under an average shade temperature of 68 deg. F. These combined stages in the summer brood, however, during January occupy a period of only twelve days, the average temperature at that time being much higher (about 82 deg. F.).

"The method of handling larvæ and pupæ of digger-wasps adopted by the writer in 1918 is illustrated in the accompanying photograph of a portion of a breeding-tray stocked with rows of victimised grubs, together with egg, maggot, and cocoon stages of the parasite.

"Each wasp is confined in a small metal cage enclosing a cane-grub covered by about 14 cub. in. of soil, the helpless grub being removed daily and a healthy one supplied. The paralysed hosts are then transferred at once to a breeding-tray of damp compacted soil, in which numerous shallow concavities have been impressed. The wasps are fed daily with honey and water, and, although subjected to close confinement, live about a couple of months.

"From data just obtained it appears that there are four broods of the digger-wasps *Campsomeris tasmaniensis* and *C. radula* every year. Those giving rise to what we may term the first or spring brood commence to oviposit towards the end of September, the earliest eggs having been obtained on the 22nd and 27th of that month. Egg-laying, however, becomes general towards the end of October, and the wasps finally emerge from this brood about the middle of December.

"The period occupied by the summer brood, or second generation, extends approximately from middle of December to middle of February.

"The autumn, or third generation, originates from wasps emerging throughout March, oviposition occurring from about the end of that month to beginning of May, and flighting of the adult wasps from May to August.

"Eggs producing the winter brood are laid in June and July; and at present we have only cocoons, from which wasps of the fourth generation are expected to emerge in a week or so.

"Further details of technique employed in this connection need not be given here, but it may be of interest to state that in the event of our deciding to introduce wasp parasites from other countries, we shall be in a position to handle them during transit in a manner best calculated to keep them alive and ensure successful introduction.

"THE CANE-BORER AND ITS PARASITE.

"A trip was taken to Babinda on 31st August, and again on 19th September, with the object of securing specimens of Tachinid fly parasites (*Ceromasia sphenophori*). Thanks to the courtesy of Mr. A. McColl, manager of Babinda Central Mill, I was enabled to visit Meriwinni, Mooliba, and other districts, in company with one of the cane inspectors, Mr. G. Robinson.

"As a result of our investigations a number of Tachinid flies were captured, with which to commence breeding experiments at Meringa.

"These were found resting on loaded trucks of cane, some in the mill yard and others at Mooliba. Pupæ of the fly were also located in borer-infested cane from several farms, so that it should not be a difficult matter to breed hundreds of specimens of this parasite for future liberation in districts affected by the beetle-borer around Babinda and Gordonvale. Growers in the former area that may be troubled with the borer are, therefore, asked to forward samples of infested stalks to Meringa railway station for examination. It would not be much trouble to cut a sack-full of badly bored cane; and such consignments would be of considerable value to us, and receive due acknowledgment and report.

"The fact of this parasite being in evidence at present on farms that are suffering greatly from borer attack indicates either that its work is inefficient, or that its increase is being constantly checked in some way. Unfortunately, burning of the trash, although doubtlessly helpful in controlling the borers, destroys also its parasites. Continued indiscriminate burning would, before long, probably result in

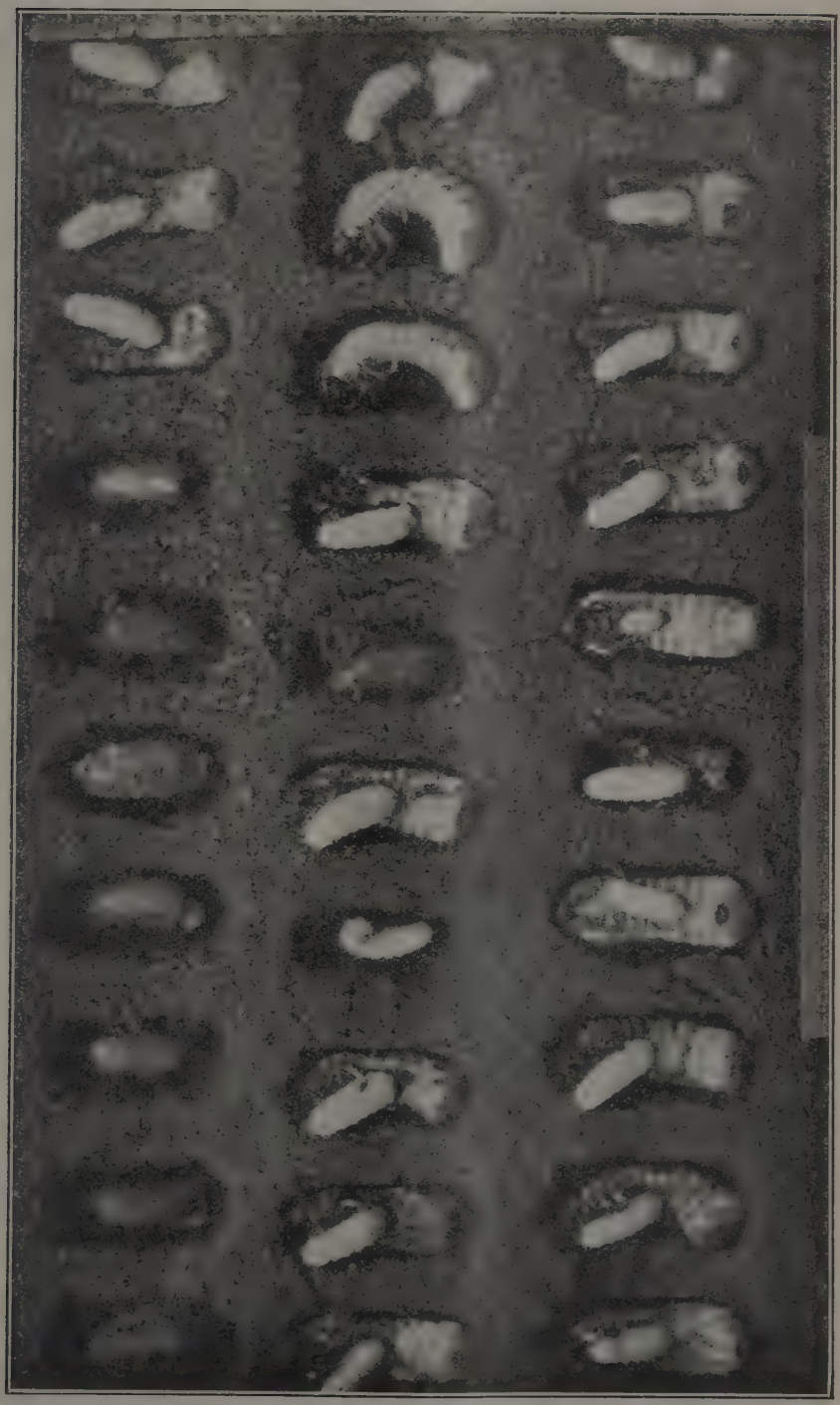

Photo. by E. Jarvis.]

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PLATE 72.—PORTION OF BREEDING-TRAY HOLDING LIFE-CYCLE STAGES OF THE DIGGER WASP (*Campsomeris tasmaniensis* Sauss.); half natural size.

disappearance of the fly from such localities. A small patch of bored cane should accordingly, when possible, be reserved in some obscure quarter as breeding-ground for the fly, and this should not be burnt.

"Bait collecting has achieved great results in times past; and since this method of control is within reach of every grower, and affords a means of materially checking the ravages of this pest, its merits should not be altogether overlooked. These baits consist, as most growers are aware, merely of pieces of split cane about 18 in. long, which are placed in heaps—of from ten to twenty pieces—near or among the cane plants. As a result of rather extensive experimentation in Fiji, it was seen that molasses smeared on the baits did not make them more attractive, and that baits cut from decomposing canes attracted far more borers than those consisting of fresh cane. It appears, also, that collections made every second day from heaps placed near the border of a plantation gave better results than frequent collections (three times a day) derived from single baits laid throughout the field.

"With regard to the question of collecting the beetle-borer, I may mention that about 3,600 specimens weigh 1 lb., and that this number of weevils is able to destroy at least 5 acres of cane. In cases of severe infestation it would, I think, be well worth our while to collect them. By laying bait-traps immediately after cutting the crop, large numbers can be caught at little expense, as the beetles that have been dislodged from the cane usually concentrate on these baits for many days after the crop has been cut.

"Some plants of the cane H.146, a variety which is said to be resistant to attacks from the beetle-borer, have just been received from the General Superintendent, and a grower at Gordonvale has been kind enough to plant them among a patch of D.1135, on land that is usually favoured by this pest. It will be interesting to note, later on, whether the borer-beetle attacks the surrounding cane in preference to the variety in question."

DESCRIPTION OF PLATE.

Row 1.—Cells Nos. 1 to 10; maggots of wasps feeding on cane-grubs.
Row 2.—Cells Nos. 8, 9; eggs of wasps attached to grubs, near legs.
Row 3.—Cells Nos. 1 to 7; cocoons of wasp.

Photo. Live Stock Bulletin.]

PLATE 73.—LYNDHURST PRINCESS IMPERIAL, THE PROPERTY OF MR. C. E. McDOUGALL. First Prize Shorthorn Cow, 4 years or over; and First for Cow with Calf at Foot, Brisbane Exhibition, 1921.

Chemistry.

ANALYSES OF FERTILISERS.

By J. C. BRUNNICH and A. F. BELL.

As the **value** of any **artificial fertiliser** depends entirely on the relative amounts of the principal constituents—**nitrogen, phosphoric acid, potash,** and **lime**—contained therein, it is customary to analyse samples of fertilisers on the local market from time to time.

For the protection of the farmers and fruitgrowers, Fertilisers Acts are framed, and as our Department found that "The Fertilisers Act of 1914" did not prevent the sale of inferior products, of very varying composition, as fertilisers, the powers under this Act were extended by "The Fertilisers Act Amendment Act of 1916."

The definition of **"Fertiliser"** under the combined Acts reads:—

> "Any substance or compound containing in appreciable quantity nitrogen, phosphoric acid, potash, or lime, manufactured, produced, or prepared in any manner for fertilising the soil or supplying nutriment to plants; also any excrement of animals or any natural substance or natural product which is used for fertilising the soil or supplying nutriment to plants: Provided that the term does not include farmyard manure, stable manure, seaweed, crude nightsoil."

It will be seen that now only such products as **stable** and **farmyard manure, crude nightsoil,** and **seaweed** may be sold as manures without guarantee of composition; any other crude product, or offal, if specially treated or not, will be classed as a fertiliser if sold for the purpose of fertilising the soil.

No person shall sell fertiliser unless he is **licensed** as a **dealer** under the Act.

Any person who desires to become licensed as a dealer shall apply in writing to the Minister for Agriculture and Stock, in the form of Schedule I. of the Act, and transmit the prescribed fee of one guinea. Such license has to be renewed annually.

As under the present amended Act lime and crude fertilisers are included, any person desiring to sell **lime, limestone, screenings, coral sand, sheep Manure, bat guano, ashes,** &c., to farmers for fertilising purposes must apply for a license.

On or before the 31st January in each year, every dealer shall deliver to the Under Secretary of the Department of Agriculture and Stock a **certificate,** in the form of Schedule III. of the Act, of the specified ingredients of each brand of fertiliser sold by him. Such statement may be amended at any time during the year.

Such **certificate** of **fertiliser** shall set forth the full name and place of business of the dealer, the name of the fertiliser, and the figure, or trade mark, or sign under which such fertiliser is sold, and a chemical analysis certifying that such fertiliser contains certain amounts of specified ingredients, and, in the case of bonedust or bonemeal, basic slag or Thomas's phosphate, air-slaked lime, agricultural lime, and gypsum, the percentage of fine and coarse material.

Upon the **sale** of any fertiliser, the dealer shall, at the time of sale or before delivery of the same, give to the buyer an **invoice certificate** signed by the seller or his agent, stating the full name and place of business of the dealer; the name, trade mark, brand, or sign used to mark packages containing such fertiliser and used to identify such fertiliser; the quantity or net weight of fertiliser comprised in the sale; the composition of the fertiliser, setting forth the proportion per centum in which such fertiliser contains the following ingredients:—Nitrogen, phosphoric acid, potash, and lime, and the respective forms in which they respectively occur ; and, in the case of bonedust, basic slag, agricultural lime, &c., the percentage of coarse and fine material.

Furthermore, every dealer who sells fertiliser, which term includes offering or exposing for sale and having in possession for sale, shall securely **affix** to each package a printed **label,** clearly and truly certifying:—The number of net pounds of fertiliser in the package; the figure, trade mark, or sign under which the fertiliser is sold; the chemical composition of the fertiliser, in the same manner as stated on invoice certificate; and the state of fineness for certain fertilisers.

A certain amount of **latitude** in the composition is allowed under the Act, in order to allow for slight variations in manufacture; and the **deficiency** between the amount of fertilising ingredient found and the amount guaranteed on the invoice and labels, must, in the case of nitrogen and potash, be now more than 5 per cent. or 1/20 of the total amount of nitrogen or potash certified to be present, and in the case of phosphoric acid and lime not more than 7 per cent. of the total amount.

On all schedules and labels the amounts of fertilising ingredients have to be stated in a uniform manner, as the old expressions—like bone phosphate, tricalcic phosphate, ammonia, ammonium sulphate, potassium sulphate, &c.—are liable to mislead the farmer. The Act provides for the statement of the valuable fertilising ingredients in percentage amounts of **Nitrogen** (N), **Potash** (K_2O), **Phosphoric Acid** (P_2O_5), **Lime** (CaO).

The **conversion** of the amount of **fertilising compound** into another is very simple, and, as many old manuring formulae still give the old denominations, we will herewith give a table which can be used for such calculation:—

Amount of—		Multiplied by—	Gives the Coresponding Amount of—
Ammonia	NH_3	0·824	Nitrogen, N
Ammonium sulphate	$(NH_4)_2SO_4$	0·212	Nitrogen, N
Sodium nitrate (Chili saltpetre)	$NaNO_3$	0·165	Nitrogen, N
Potassium nitrate (saltpetre)	KNO_3	0·139	Nitrogen, N
Nitrogen	N	1·214	Ammonia, NH_3
Nitrogen	N	4·714	Ammonia sulphate
Potassium sulphate	K_2SO_4	0·541	Potash, K_2O
Potassium chloride or muriate	KCl	0·631	Potash, K_2O
Potassium nitrate	KNO_3	0·466	Potash, K_2O
Potash	K_2O	1·850	Potassium sulphate
Tricalcic phosphate (bone phosphate)	$Ca_3P_2O_8$	0·458	Citrate insoluble Phosphoric acid P_2O_5
Monocalcic phosphate (superphosphate)	$CaH_4P_2O_8$	0·607	Water soluble Phosphoric acid P_2O_5
Tetracalcic phosphate	$Ca_4P_2O_9$	0·391	Citrate soluble Phosphoric acid P_2O_5
Limestone, marble	$CaCO_3$	0·560	Lime, CaO
Gypsum	$CaSO_4$	0·411	Lime, CaO

Lime may be used in several forms, and the amended Act provides for four classes—

(a) **Caustic lime,** or burnt lime, or quicklime, containing the lime in form of calcium oxide (CaO);

(b) **Mild lime** or air-slaked lime, containing the lime chiefly in form of hydrate of lime ($Ca(OH)_2$), obtained by slaking of burnt lime with water;

(c) **Agricultural lime,** containing lime in the form of carbonate of lime ($CaCO_3$), and obtained by crushing or pulverising of limestone, marble, coral, and shells;

(d) **Gypsum,** containing lime in the form of sulphate of lime ($CaSO_4$).

The action of lime in form of powdered quicklime or air-slaked lime is very rapid and powerful, and application is only recommended to very stiff clayey and very acid soils. The safest form is generally agricultural lime, but on account of its insolubility the limestone, in order to become gradually available, must be ground very finely, so that the largest percentage goes through a sieve with forty meshes to the linear inch or 1,600 meshes to the square inch.

In many cases a mixture of quicklime and crushed limestone is found particularly beneficial, combining the quick and slow actions of the two forms; and when, for instance, 1 ton of lime per acre is recommended to be applied, a mixture of 5 cwt. of air-slaked quicklime and 15 cwt. of crushed limestone or agricultural lime could be used.

With reference to **"Mixing of Fertilisers,"** a short article was published lately in the August number of this Journal.

The **monetary manurial value** per ton has been fixed for some time under "The Profiteering Prevention Act of 1920." The **unit values,** which are the cost price of 1 per centum of the various fertilising constituents per ton, or the actual cost value of every 22.4 lb. of such constituent, have been fixed as follows:—

	s.	d.
Nitrogen—		
In dried blood	26	0
In bone, flesh, and offal, fine	24	0
In bone, flesh, and offal, coarse	21	0
In bone, flesh, and offal, unspecified	17	0
In bone, flesh, and offal, unspecified lumps	14	0
In nitrate of soda	35	6
In ammonium sulphate	23	0

	s.	d.
Potash—		
In sulphate of potash	18	0
In muriate of potash	12	0
Phosphoric acid—		
As water soluble in superphosphate	9	3
As citrate soluble in basic superphosphate and Thomas's phosphate	9	0
As citrate soluble in finely ground island phosphate and guano	5	6
As bone, &c., fine	5	6
As bone, island phosphate, and guano, coarse	4	3
As finely ground mineral rock phosphate	4	3
As bone, island phosphate, guano, unspecified or unspecified lumps	3	0
Lime as ground lime carbonate	1	0

From these unit values the **cost** of any fertiliser may be calculated, and, for instance, the local cost of "Orchard Manure" No. 211, containing 2.7 per cent. nitrogen, 16.8 per cent. total phosphoric acid, of which 14.5 per cent. is water soluble and .8 per cent. citrate soluble, and 4.1 per cent. of potash, would be as follows:—

	£	s.	d.
2.7 per cent. nitrogen as ammonium sulphate, at 23s. ..	3	2	1
14.6 per cent. phosphoric acid as water soluble, at 9s. 3d. ..	6	15	1
.8 per cent. phosphoric acid as citrate soluble, at 5s. 6d.	0	4	5
1.4 per cent. phosphoric acid unspecified, at 3s.	0	4	2
4.1 per cent. potash as muriate, at 12s.	2	9	2
Mixing charge	1	0	0
	£13	14	11

In many cases specified charges for freight, rebagging, and retailing are allowed, and additional costs for fertilisers sold and manufactured north of Mackay.

A considerable reduction in these costs is to be expected shortly, and ammonium sulphate and also potash salts can be already imported from the South at lesser cost.

Any reduction in the cost of fertilisers is of vital importance to agriculture, in order to allow a much more extensive use. The proper use of fertiliser is fully explained in a little pamphlet, **"Complete Fertilisers for Farm and Orchard,"** which may be obtained on application from the Department of Agriculture and Stock.

We have numerous instances of the **excellent results** obtained by fertilising and liming soils, and it is interesting to record that, in spite of highly fertile lands available and in use for pineapple culture in Queensland, record crops were grown on comparatively poor sandy soils by judicious application of **lime** and **artificial fertilisers.** On the same farms timely application of certain nitrogenous fertilisers, recommended by us, to crops, which due to adverse climatic conditions were very backward and promising failure, produced immediate recovery and excellent yield.

Any farmer in doubt about the quality of fertiliser purchased should at once apply to the nearest inspector under the Act, in order to let him draw a sample and submit same for analysis. All inspectors appointed under "The Diseases in Stock Acts, 1896 to 1898," "The Diseases in Plants Act of 1896," "The Dairy Produce Acts, 1904-1911," and the expert and inspectors under "The Pure Seeds Acts of 1913 and 1914" are officers under the Fertilisers Act.

Under the Fertilisers Act samples of the various fertilisers on the market were obtained and analysed. The results are given in the following table, and in the few cases where **deficiencies** in the fertilising ingredients were found the **values** are **printed in heavy type.**

We also give a table showing the fertilising value of **wood and plant ashes.** It will be noticed that the actual percentages of ash obtained in most cases are very small, and that the ashes of most of our timbers contain large amounts of lime. From prickly-pear we get an average of about 2 per cent. of crude ash, which contains 9.5 per cent. of potash, so that 1 ton of our ordinary pest pear would yield about 4 lb. of potash if all the ash could be collected.

A table giving the manurial value of the **excreta** of the different **animals,** and also of the materials commonly used as **litter,** &c., is added for general information.

Analyses of Fertilisers.

Lab. No.	Fertiliser.	Where Obtained.	Nitrogen, N.		Phosphoric Acid P_2O_5.						Potash, K_2O.		Fine.	Coarse.
					Total.		Water Soluble.		Citrate Soluble.					
			Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.		
			%	%	%	%	%	%	%	%	%	%	%	%
190	Dried blood	Q.M.E. Coy.	12·2	11·8	..	..	..	..	..	..	..	..	..	..
191	ditto	A.M.E. Coy. (225)	12·7	13·0	..	..	..	..	..	..	..	..	..	..
192	ditto	A.M.E. Coy. (168)	12·3	13·0	..	..	..	..	..	..	..	..	..	..
193	ditto	Birt and Co.	12·5	12·9	..	..	..	..	..	..	..	..	..	..
194	ditto	Aust. Co-op. Fert.	12·0	12·0	1·8	1·5	..	..	..	..	..	..	..	..
184	Fertiliser	J. C. Hutton	4·7	5·0	17·3	14·5	3·7	4·0	..	..	..	..	..	..
185	ditto	Q. Co-op. Bacon Coy.	5·0	4·7	**13·9**	17·6	..	..	..	..	..	..	..	..
186	ditto	Birt and Co.	5·4	5·0	16·3	17·1	..	..	..	..	..	..	..	..
187	ditto	Baynes Bros.	4·8	4·8	17·2	18·5	..	..	..	..	..	..	..	..
188	ditto	A.M.E. Coy.	6·3	6·5	12·6	11·0	..	..	..	..	..	..	..	..
189	ditto	Foggitt, Jones	4·3	4·3	17·2	17·9	..	..	..	..	..	..	..	..
195	Natural guano	State Produce Agency	·3	·15	13·3	12·0	..	..	..	..	1·1	·5	..	..
196	Holbourne Island (Phosphate, &c.)	Aust. Co-op. Fert.	..	..	22·1	17·0	..	..	10·4	8·0	..	..	..	..
197	Bonemeal	A.M.E. Coy.	3·7	3·5	24·6	25·0	..	..	..	..	..	..	32·8	67·2
198	ditto	A.C.F. (Jordan's)	3·2	3·5	25·2	21·0	..	..	..	..	..	..	**26·8**	73·2
199	ditto	A.C.F. (Runcorn)	3·4	3·7	26·0	22·0	..	..	..	..	..	..	**28·7**	71·3
200	ditto	H. A. Petersen	**3·3**	3·8	24·8	24·0	..	..	..	..	..	..	**21·8**	78·2
201	ditto	E. A. Jordan	**3·2**	3·8	23·6	24·0	..	..	..	..	..	..	**30·5**	69·5
202	ditto	Webster and Co.	3·4	3·1	25·2	24·0	..	..	..	..	..	..	**33·4**	66·6
203	Ammonia sulphate	Aust. Co-op. Fert.	21·1	21·0	..	..	..	..	..	..	..	..	..	..
204	ditto	N.Z.L. and M. Agency	20·0	20·0	..	..	..	..	..	..	..	..	..	..
205	ditto	Webster and Co.	20·9	20·0	..	..	..	..	..	..	..	..	..	..
206	ditto	Brisbane Gas Coy.	21·1	21·1	..	..	..	..	..	..	..	..	..	..
209	Nitrate of soda	Aust. Co-op. Fert.	16·5	15·5	..	..	..	..	..	..	..	..	..	..
207	Muriate of potash	ditto	..	..	..	..	..	..	..	..	57·6	53	..	..
208	Superphosphate	ditto	..	..	21·7	18·0	19·8	17·0	..	·5	..	..	..	..
210	ditto	N.Z.L. and M. Agency	..	..	22·5	18·0	19·8	17·0	..	·5	..	..	..	..
211	Orchard	ditto	2·7	2·3	16·8	14·5	14·6	13·0	·8	·8	**4·1**	4·5	..	..
212	Bone and super.	ditto	2·2	1·5	23·2	19·0	8·4	8·5	5·4	2·5	..	..	..	..
213	Special orchard	ditto	2·7	2·3	15·3	12·8	13·4	12·0	·9	·4	8·1	7·3	..	..
216	Superphosphate	Paul and Gray	..	..	24·1	..	20·1	17·0	..	..	..	..	..	..

Analyses of Wood and Plant Ashes.

—	—	Per cent. of Crude Ash in Wood or Plant.	IN CRUDE ASH: Per cent. Phosphoric Acid.	Per cent. Potash.	Per cent. Lime.
Apple-tree (*Angophora*)	..	..	·3	4·5	29·9
Banana plant (Cavendish)	Buderim	1·3	1·5	36·6	21·3
Belar	..	..	·02	4·9	49·1
Blackbutt (*Eucal. pilularis*)	Yandina	·1	2·7	15·9	14·4
Bloodwood, red (*Eucal. corymbosa*)	ditto	·08	2·0	12·7	12·5
Ditto	Bunya	·07	5·0	13·3	17·8
Blue gum (*Eucal. tereticornis*)	ditto	·13	14·0	9·1	19·2
Bottle-tree (*Sterculia rupestris*)	..	2·0	·2	29·0	23·5
Brigalow (*Acacia harpophylla*)	..	..	..	·9	54·4
Bumpy ash (*Flindersia Schottiana*)	..	·5	2·2	20·5	51·9
Camphor laurel	Brisbane	1·0	6·3	36·3	23·0
Cedar, red (*Cedrela australis*)	..	·8	9·4	19·7	39·2
Cotton, pods	..	5·3	2·2	29·9	8·3
Crow's foot elm	Atherton	..	6·2	5·8	46·9
Forest oak (*Casuarina torulosa*)	..	·4	1·6	11·9	64·6
Gidgea (*Acacia homalophylla*)	..	..	·9	1·1	48·7
Grey gum (*Eucal. propinqua*)	Bunya	·2	6·5	11·4	28·9
Hoop pine (*Auracaria Cunningh.*)	Ipswich	·7	1·0	17·9	48·7
Ironbark, red (*Eucal. siderophloia*)	Bunya	·08	3·9	6·4	22·8
Lantana (whole shrub)	..	..	3·6	14·0	17·0
Lantana (leaves and twigs)	..	..	3·5	11·8	11·5
Mangrove (leaves and twigs)	Russell Isl.	..	2·0	8·1	16·0
Mangrove (leaves and twigs)	Sandgate	..	2·1	4·4	12·3
Mangrove (black)	Cairns	..	·6	1·3	35·9
Nettlewood	Crow's Nest	3·4	4·1	6·5	28·1
Oregon pine	..	·8	·5	1·3	29·1
Pineapple, whole plant, rough and smooth	Nundah, &c.	1·1 to 2·6	2·2 to 6·0	9·3 to 15·0	5·8 to 7·0
Prickly-pear (*Opuntia inermis*)	Dulacca	1·2 to 2·6	·5	9·5	19·9
Red stringy bark (*Eucal. resinifera*)	Yandina	·05	·8	9·2	17·3
Sawmill ashes (chiefly pine)	..	..	1·1	8·7	34·1
Sawmill ashes (chiefly hardwood)	..	..	·6	1·9	29·3
Scrub box (*Tristania conferta*)	Yandina	·8	·3	7·9	31·1
Sisal hemp	Isis	..	4·6	8·0	31·9
Stinking Rodger (*Tagetes glandulifera*)	Maroochy	2·6	15·8	20·0	27·2
Sugar-cane tops	..	1·5	4·9	13·0	6·8
Sugar-cane trash	..	6·6	3·2	4·9	4·0
Tallowwood (*Eucal. microcorys*)	Yandina	·2	·4	2·4	52·2
Tobacco plant	..	..	5·4	27·1	40·7
Turpentine (*Sincarpus laurifolia*)	Yandina	·4	·4	1·2	1·9
Yellow stringybark (*Eucal. œmenoides*)	Bunya	·06	2·1	9·5	9·5

Composition of Excreta and Litter.

	PERCENTAGE OF :					
	Water.	Organic Matter.	Nitrogen.	Total Ash.	Phosphoric Acid.	Potash.
Horse dung	75·8	21	·5	3·2	·3	·4
Horse urine	90·0	7	1·5	3·0	trace	1·6
Cow dung	83·5	14·6	·29	1·9	·2	·1
Cow urine	93·8	3·2	·6	3·0	trace	1·3
Sheep dung	65·5	31·4	·6	3·1	·3	·2
Sheep urine	87·5	8	1·9	4·5	trace	2·3
Pig dung	79 to 84	10 to 15	·4 to ·7	3 to 5	·1 to ·4	·3
Pig urine	97·5	1·5 to 2·8	·4	1 to 1·5	·1	·7 to ·8
Hen manure	59·7	29·4	·8 to 1·6	8·4	·5 to 1·5	·6 to ·9
Litter—						
Straw (cereal) ..	12 to 21	75 to 83	·3 to ·9	3 to 8	·2 to ·3	·5 to 1·1
Straw (leguminous)	12 to 22	76 to 83	1·2 to 2·0	3 to 9	·3 to ·4	·6 to 1·8
Leaves, dry ..	13 to 15	78 to 81	·8 to 1·4	4 to 6	·2 to ·3	·2 to ·4
Sawdust	32·5	62·3	·8 to 1·0	·3 to 2	·05	·10
Tannery refuse	6·4	33·8	·2	..	·04	·08
Human excreta ..	77·2	13	1·0	3·0	1·1	·25
Human urine	95·9	4	·6	1·0	·17	·20

Photo. Live Stock Bulletin.]

PLATE 74.—SEGIS PIETERTJE PROSPECT.

An American Friesian, the new World's Champion Milk Producer. Official test figures at age of 6 years :—1 year, 37,384 lb. milk, yielding 1,445·9 lb. butter ; 7 days, 33·18 lb. butter.

CATERPILLAR PLAGUE.*

(*Leucania unipuncta*, Haw.)

By HENRY TRYON, Entomologist.

(PLATES 75, 76, and 77.)

INTRODUCTORY.

AT two periods of the year—September-October and March-May—reference may be found in the Press to serious ravages committed on pasturage and cereal crops by caterpillars. These caterpillars are the young of two night-flying moths, known, respectively, as *Leucania unipuncta*, Haw. (*extranea*, Gn.) and *Spodoptera mauritia*, Boisd.† Of these, the former is the insect that is generally concerned, and is the one to which subsequent remarks will be confined.

This insect is one whose range of occurrence is very extended, being met with, according to E. Meyrick, not only in Australia and New Zealand, but also in Europe, Southern Asia, and North America. In the last-mentioned region it bears the significant name of "army worm."

As a caterpillar, a chrysalis, or a moth, it is to be observed in districts that it affects throughout the year in varying degrees of prevalence. It has many enemies. Not only do birds devour it, but it is the prey also of many carnivorous insects. It is, however, most effectually held in check by internal parasites and disease—both fungus and bacterial; and, moreover, special meteorological conditions determine the death of its eggs. Under ordinary circumstances these factors prove competent to hold it entirely in subjection; and it is only when, under conditions that are not fully understood, their operation is temporarily suspended, that a caterpillar plague manifests itself. The occurrence of the insect in formidable numbers is also the occasion for its enemies to assert their fullest influence. Hence it usually happens that a district is rarely visited in successive seasons by this pest, and, indeed, years may sometimes elapse between one visitation and another.

NATURE OF INJURY.

The caterpillars consume the foliage and stems of various species of native grasses, also those of introduced kinds—such as Panicum and Prairie (*Bromus unioloides*)—grown for hay or other purposes. They also devour oats, rye, barley, wheat, maize, sorghum, and possibly young sugar-cane; and will sustain themselves by nibbling, and so damaging, the shoots of lucerne, and even those of the potato. In the case of wheat

* This is a reprint of an article that appeared in the *Queensland Agricultural Journal* for February, 1900, *op. cit.*, volume VI., page 135-147, and is issued as relating to a subject of interest at this time of the year.—ED.

† The insect is distinct from *S. acronyctoides*, Guen., of which *S. mauritia* (Boisd.) is a synonym. Hampson in 1909 named it *Laphygma leucophlebia*, Hmps.

not only is the flag consumed but the spikelets of the head may be eaten right back to the rachis, as is represented on Plate 75. Rye in ear they will simply strip of every leaf, the bare stalks and heads alone remaining. Should the cereal not have already flowered, it may be eaten down to the ground: a remark that especially applies to young maize, no vestige of which may remain after caterpillars have passed over a field devoted to this crop. When young wheat has already been cut and tied up, the caterpillars may even eat the top of the shooks back for several inches. And when exceptionally the growth is sufficiently advanced at the time of their visitation, for the crop, after cutting, to be dried for hay without risk of heating, it may be found that it has already become so soiled by the dead bodies of the marauders as to be wholly rejected by the animals to which it is presented, either in the form of chaff or otherwise. Their destructive action, moreover, is not only thorough but it is also extensive. In the district of Ma Ma Creek, quite 200 acres were seriously damaged or destroyed by this pest during September, 1899; and on the Darling Downs caterpillars rendered single plots of barley and wheat, 100 acres in extent, not even available for straw.

THE INSECT.

The special depredator referred to as *Leucania unipuncta* occurs under four different phases or conditions, viz.:—The Moth, the Egg, the Caterpillar, and the Chrysalis.

The Moth (*vide* Plate 76, Figs. 1 and 2).—Generally speaking, the moth is clay or fawn coloured, with the forewings—of this colour—very thickly speckled with black, and having a minute white spot in their centres, and the hindwings, that are paler outwardly, blackish-brown. It may measure nearly 2 inches across the wings. The following more detailed description is taken from one of the writer's previous memoirs:—

"*Male.*—Fawn-coloured. When undisturbed the wings are directed backwards behind the body, so as to make an angle one with the other. Their surfaces are inclined, and their outer borders when in this position leave an angle between them. The eyes are brown, large (and hairy). There is a frontal tuft of brown black-tipped scales between the latter; the antennæ are minutely ciliated (in the males). The body is stout and tapers towards the tail, that is terminally tufted. The thorax is clothed with fawn-coloured hairs, and has a faint yellow dark-edged transverse stripe on the forepart between the anterior wings, and two oblique rows of black points on the hinder portion, meeting at an angle on the middle line. The abdomen is lighter brown, and without crests. The forewings are elongated, their anterior margin is straight, and their external slightly oblique. Each has a dark discal spot, containing a white point, anterior to which is a light-chestnut suffusion; a short oblique subapical brown streak; a line on the outer margin, and an exterior transverse one, of black points; internal to the latter line and between it and the discal spot is an interrupted waved brown stripe, often scarcely discernible. Hindwing short, broad with apex rounded, and external margin undulated; grey, passing into dark cinereous towards outer border (very distinct beneath); anterior border, yellowish-white; cilia, light-yellowish white. Beneath lighter coloured than above; a longitudinal line containing a few distinct black spots on each side of the abdomen; front border and outer portion of forewings, and fore border of hindwings, with light-black speckled scales; a cloud of dark cinereous colour across the outer third of forewing. Legs light-grey with black specks; fore tibiæ with two and hind tibiæ with four spurs. Extreme length when undisturbed, $\frac{4}{5}$ inch; expanse of wings, $1\frac{5}{7}$ inch; length of body, $\frac{3}{10}$ inch."—*Insect and Fungus Pests*, page 224: Brisbane, 1889.

Egg.—The eggs are spherical, somewhat flattened above, and measure about $\frac{1}{30}$ inch in diameter. Their surface is symmetrically rugose, but this feature is generally obscured by certain sticky matter with which they are covered at the time of their being laid. They are yellowish-

white in colour, but darken with age. (The accompanying figure (1) displays eggs, of nearly natural size, *in situ* on the plant, and their appearance when magnified.)

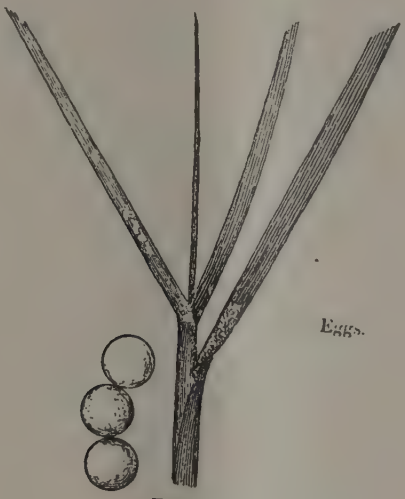

FIG. 1.

THE CATERPILLAR (Plate 76, Fig. 4).—The caterpillars attain a length of 1½ inches and are nearly ¼-inch in diameter. They vary in colour with age. Thus, when newly hatched, they are translucent and almost white; then they acquire a greenish tinge, and later they become darker and have stripes that extend along the sides of their bodies. Still later, when about to become chrysalises, they are lighter coloured again, and meanwhile the stripes have changed to a paler hue. There are also dark and light varieties of the same age. The following detailed description will serve to more definitely define the characteristic features of the insect:—

A smooth-surfaced caterpillar, with a cylindrical body gradually narrowed towards the head, more suddenly towards the tail; the twelfth segment without transverse keel above. The mandibles brown bordered with black; the labrum is sinuated anteriorly and whitish; the anterior clypeus is longitudinally wrinkled; the posterior clypeus has a few transverse fine striæ, and is white with a central longitudinal brown mark, or is brown with a white border; top and sides of the head netted white and brown; prothoracic plate (shield behind the head), dark-brown, remainder of body greyish-brown (under the lens appearing mottled-brown on a white ground); thoracic legs, whitish with brown claws; abdominal prolegs, white, each with a transverse broad smoke-coloured band on its outer surface; spiracles, black (under-surface greenish, grey at the sides); two light-yellow broad stripes extend on each side of the back from the fore-border of the prothoracic plate, and are irregularly edged with black above; midway between them, along the centre of the back, is a third stripe of the same colour; this is usually interrupted and very indistinct. Below the dorso-lateral stripes are two bands on each side extending the whole length of the insect—one is along its inferior border contiguous to the spiracles, and the other is below their level. The latter is the more conspicuous, being cream-coloured with the central area mottled with light red. There are a few slightly raised hair-bearing black points on each segment. These number twelve on a segment in the mid-region of the body, the six on each side being disposed as follows:—One above the dorso-lateral line, one in it, one above the spiracle, one below it and on its side, and one at the base of the abdominal proleg. Length of caterpillar, 1½ inches.''—*H. Tryon, op. cit.*, page 225.

The Chrysalis (Plate 76, Fig. 3).—This is of the form represented in the figure referred to. At first light-brown, it soon assumes a rich dark reddish-brown colour. It is smooth and shining, and when fully extended measures about $\frac{4}{5}$ inch in length. The three anterior segments, that correspond to the hind body of the future moth, have each on the forepart a row of punctures between the breathing pores (spiracles), and the terminal segment ends in two nearly parallel sharp depressed spines.

HABITS OF INSECT.

The moth, under natural circumstances, is nocturnal in its habits, preferring the early part of the night for its movements. It will, however, take wing during any time of the day, even during the prevalence of bright sunshine, when disturbed. Amongst disturbing agents may be mentioned the wind, especially should the moth emerge from its chrysalis in an exposed spot. Under this circumstance, also, it follows its direction with rapid movement, after taking wing with great suddenness. Whilst engaged in flight it usually passes near the surface of the ground, except during the night, when it may wend its way at a height of some feet therefrom. In settling down it runs quickly to some hiding-place, especially selecting such as presents colouration in harmony with that of its own livery. It feeds upon the nectar of flowers. Some few days may elapse between the emergence of the moth from its chrysalis in the ground and the laying of its eggs. During this interval it conceals itself by day in any vegetable *débris*, sticks, grass, boards, &c., that may be met with in its immediate environment. But it goes forth night after night to feed, many kinds of flowers affording it sustenance. Each female moth—as has been ascertained by other observers—lays from 500 to 700 eggs. The site usually chosen for their reception is afforded by young leafy shoots of some rank growing grass, or of a cereal before any appearance of the flowering-stalk has arisen, especially when thickly sown and each plant resembles a small tussock. In selecting the spot for the reception of its eggs, the parent insect seems to anticipate the requirements of its young, which are protection from light and an abundance of succulent foliage. It, however, prefers that the plant should have arrived at a certain definite stage of growth, choosing such amongst others that, though adjacent, have evinced a less rapid development. This was very noticeable in different stud wheats grown at the Hermitage State Farm in rows side by side and sown at the same time. In this instance such late varieties as Windsor Forest, New White Queen, Selected Square Head, Challenge White, and White Nursery were free from their attacks, whilst other more quickly maturing kinds growing near them were attacked, amongst which latter may be mentioned Allora Spring, Budd's Early, and Gayndah No. 4. The moth usually selects the leaf-sheath, or the spot where the flag comes away from the stem, as the site for its eggs. "When the female moth finds a stalk of grain or grass suited for her purpose, she clasps it with her legs, and thrusts her ovipositor into the unfolded base of the leaf or down into the sheath, where it surrounds the stalk" (*F. M. Webster*). Many eggs are laid together in one position at the same time (*vide* fig. 1, page 333). They are placed side by side in linear series of 20 or more, and enveloped in a sticky substance that causes them to remain adherent to the leaf surface on which they are placed and to one another. C. V. Riley states that exceptionally these are laid "in the cut straw of old stacks, or in hayricks, or even in pieces of cornstalk in the field, or in stubble." These eggs, under favourable circumstances, hatch in about a week or fifteen days. The minute caterpillars on hatching out feed

at first on the shell of the egg whence they have arisen, then on their leafy surroundings at the base of the flags, after which they enter the innermost recesses of the plant (whence they may be shaken out), or even rest immediately beneath it. During this time they inflict no noticeable injury, so that their presence may not even be suspected. Both now and at a later period in their growth, the caterpillars feed almost wholly at night, especially during bright sunny weather. When, however, rain prevails and the weather is overcast, they may crawl to the most exposed portions of the plants whereon they occur, and feed there continuously (they will also similarly remain exposed when victimised by insect or parasites or by disease). When disturbed, they immediately drop from where they were previously feeding—the very young by a thread, the older without any. Having fallen, they quickly roll themselves up with the head inwards, and remain motionless, but after a minute or two they bestir themselves, and soon crawl away. Should the plant on which they feed be isolated or offer little concealment, they spend the day concealed in the nearest hiding-place they can find, as under a stone or piece of wood; also when crawling from place to place they will rest hidden beneath clods of earth or in such like places. When disturbed, especially in cloudy weather, they will frequently, whilst resting on their abdominal prolegs, elevate the forepart of their body, and move their head to and fro with sudden jerks. This also is their habit when attacked by insect parasites, and with the presence of these they probably instinctively associate every threatening danger. When developed to a third of their ultimate size or more, they may travel extensively from plant to plant during the hours of darkness. But when more fully grown they may supplement these nocturnal excursions by much more general ones pursued during the time daylight prevails. Referring to one of these excursions, Mr. G. Anderson, of Oakey Creek, informed the writer as follows:—"The caterpillars appeared to occur throughout 70 acres of barley simultaneously. They were in immense numbers. For three days they were upon the move between the hours of 12 and 3 on each occasion, the moving mass —for such was the appearance, due to their numbers—travelling west." The *Brisbane Courier* of 22nd March, 1898, referring to an occurrence of caterpillars in the Laidley district, stated also as follows:—"Some parts of the district are being ravaged by immense armies of caterpillars that march along and eat up grass, panicum, and even tackle the maize. Some farms in their track have been completely devastated." When in the course of these general movements they have occasion to cross land not occupied by the plants to which they are especially partial, they will nibble others, and so injure them to a greater or less extent. Thus all the shoots of lucerne were seen to be destroyed in one instance in the Ma Ma Creek district; in another case nearly all the young haulms of a considerable acreage of potatoes had been gnawn down. As a rule it is not until the caterpillars are nearly full grown that attention is directed to their presence, which happens then by reason of the extent of their depredations ("the crop looking thin," as is often said) or the occurrence of such a moving host as has been alluded to.

The caterpillar takes from four to five weeks to mature, but this period is subject to variation in length, a circumstance connected with the amount of suitable food that is available for its consumption, as well as the occurrence or absence of congenial climatic conditions. Thus, during the winter, the insect will persist as a caterpillar for quite three months, during a portion of which time it remains in a semi-dormant condition.

When mature, it changes, as previously remarked, to a lighter colour, and its stripes grow paler. It then, under normal conditions, enters the ground to a depth of about 2 inches. Here, still outwardly a caterpillar, it becomes even paler in colour than before, and its body meanwhile becomes considerably shortened. In this position it may remain for two days (this period is also subject to variations in length), during which time, by special movements in different directions, it forms an oblong smooth chamber measuring about 1 inch in length, and meanwhile changes into a chrysalis such as has been described. In exceptional cases, however, it crawls beneath a stone, piece of fallen timber, sod of earth, or "land" in ploughed ground, and then transforms without constructing any chamber, though sometimes it covers itself with earth.

The insect having thus passed into a chrysalis remains in that condition usually for about two weeks; but again the time passed in this phase may vary from ten days to three or four weeks. At the expiration of this period the perfect insect or moth arises, a warm evening after rain being usually chosen for its appearance.

Although the caterpillars occurring even in the same field exhibit great variation in size and consequently in age, there are good grounds for concluding that, generally speaking, there are at least three broods, if not four, every year, although it is only during two periods of the year—September-October and March-April—that they occur of such extent as to prove noticeably destructive; their comparative smallness in the intervening periods being due to the operation of natural checks upon their growth and increase, as well as to the condition of growing crops. These three or four separate broods, however, overlap to a considerable degree. The caterpillars that were observed during 1899 in the Ma Ma Creek district from the second week in August onwards, and which had already transformed—in part—to moths by the third week of September, were no doubt derived from moths that had deposited their eggs, where these caterpillars were met with, in May. It was inferred that a similar state of things had obtained on the Darling Downs, since, in many instances, whereas wheat sown in April or May was subsequently attacked by caterpillars, that which had been planted in the same locality in June and July had escaped their visitation; a remark that also applied to both oats and barley. Where it had been otherwise, there was generally evidence forthcoming to point to a migration of caterpillars from the earlier to the later sown crop. The explanation of this is to be found in the fact that the crops, in order to evince the presence of caterpillars in September, require an access of the moths in May. If this is impracticable, they may escape their presence.

NATURAL ENEMIES.

It has already been stated in the introductory paragraph that under normal conditions the caterpillars of *Leucania unipuncta*, Haw., do not occur in such numbers as to inflict noticeable damage to pasturage, cereal, or hay crops. It is also true that when, under special circumstances, these pests have exceeded these limits in respect to numbers, forces come into operation to restore the balance of Nature by checking the enormous numerical development of these caterpillars that would follow the free exercise of their powers of increase. This experience results from the operations of so-called natural enemies, in which category may be included not only predatory birds and other insects that find sustenance in preying upon their bodies, but parasitic forms of life to which the bodies of these caterpillars serve in the general capacity of host, providing at the same time not only aliment but

dwelling-place also. As an instance of this, a plague of caterpillars caused some consternation by reason of its ravages in the district immediately to the south of Brisbane during March, 1895. The immediate descendants of these marauders still exist, a score of generations having succeeded one another since then; and yet we have learnt of no further trouble from caterpillars in the districts alluded to. But that this would be so was predicted by the writer at the time, after having remarked the extent to which parasitic insects had victimised these grubs concerned in the ravages complained of. And, in addition to the insect parasites, there are also certain fungi (Entomophthoreæ) and bacteria that produce general and fatal disease in the course, too, of their parasitic life in the tissues of these insects.

In the case of the visitations of caterpillars in September-October, 1899, that have suggested the preparation of this article, similar checks on increase were also operative, and no doubt in consequence similar beneficial results to those above alluded to will follow in most of the localities that have suffered. In the present instance parasitic insects were principally concerned, and amongst these the following are worthy of being especially mentioned:—

A.—Insect Parasites.

Theronia rufipes, sp. nov. The Red Ichneumon. (Plate 77, Fig. 2).—This is a deep-red and glossy insect, having smoke-coloured wings that appear steel-blue in certain lights, and the anterior two-thirds of its hind body black and conspicuously spotted with a row of large white spots along each side. Very large female examples may be 11 lines in length, and have a wing spread of nearly 1½ inches, but as a rule in this sex their measurements are respectively 8 lines and 1 inch. These insects during overcast weather may be seen to alight on and explore in plants that are frequented by caterpillars; but it is during the prevalence of hot sunshine that they occur in greater numbers, though their extreme activity then often leads to their being overlooked. At this time, however, they may be remarked, passing rapidly to and fro just above the surface of the grass or cereal crop, ever and anon suddenly alighting and creeping amongst the herbage. Even at nightfall they are still at their posts, remaining three or four together stationary on the grass stems. On discovering a caterpillar they soon settle upon it after exploring it from all sides with their feelers, and notwithstanding the violent contortions into which it throws its head and body. Then they probe it deeply with their black needle-like ovipositor (composed of three separable parts and measuring ½-inch in length), and so place within its body one or more of their eggs. It is probably also that at the same time they either disperse in the air or inject into the tissue of their victim a fluid analogous to formic acid that they secrete, and that may serve the purpose either of an anæsthetic or preservative. One, at least, of the eggs of the ichneumon thus inserted hatches into a maggot that feeds within the caterpillar, and continues to develop as the growth of the latter is still continued; but at the same time it avoids touching organs the injury of which would result in speedy death.

Meanwhile, the caterpillar enters the ground, and, in the majority of instances, transforms to a chrysalis. Further transformation on its part is, however, restrained, for, instead of a moth emerging from the ground, there issues the red-bodied ichneumon fly, which digs its way to the surface through a small circular hole, that is sufficiently large to be readily perceived.

In the case of some chrysalises of grass-feeding caterpillars (*Laphygma leucophlebia*) obtained during April, 1895, in the Tingalpa district, through the instrumentality of Mr. A. Grieve, it was remarked that, with the exception of an exceedingly small percentage, all gave birth to these parasites in lieu of moths.

It is, however, in attacking belated caterpillars that these ichneumons are most serviceable. When the *Theronias* emerge from the bodies of their hosts there are always a few caterpillars that have not as yet transformed to chrysalises. These, however, the female ichneumons search out with great pertinacity, and so ultimately destroy. Their presence in numbers on pasturages previously visited by caterpillars is often remarked by graziers, who are led to question the significance of this phenomenon. This happened in the case of the caterpillar plague at Rockville, Mombra, in 1896 (*T. Nicholson*). Mr. A. Grieve, in the instance above quoted, drew attention to the fact that the ichneumons that were hatching out under his observation were nearly all males—a fact that subsequently received corroboration from the experience of the writer. In this instance, moreover, it did not appear that it was a case of protandry, as has been noticed in the case of the related insect, *Pimpla inquisitor*, Say., by C. O. Howard in the United States. "With this species" he remarks ("Study on Insect Parasitism," page 13), "as with so many other parasitic Hymenoptera, and indeed as with so many other insects in general, there was a marked priority in the issue of the males." He then gives a tabulated statement showing that male *P. inquisitor* were appearing for seven successive days prior to the emergence of any female examples of the species.

As this insect does not appear to have been described and is of great economic interest, the following technical description is appended to ensure its correct identification:—

Theronia rufipes, sp. nov.—*Female*: Red, four anterior segments of hindbody, deep bluish black, each with a large ovate white spot on the side adjacent to the hind border, forming a lateral longitudinal series. Wings, fuliginous the fore ones having dark steel-blue reflections, especially towards the base; antennæ outwardly, tarsus of hind legs and ovipositor fuscous. Altogether smooth and glossy. Hindbody impunctate. Head and thorax very faintly punctured. *Head* not lengthened, with straight fore-border; antennæ situated in a broad shallow concavity, eyes excavated opposite the origin of these; vertex narrow with rather sudden occipital slope. *Thorax*, mesonotum without wrinkles; scutellum convex with two lateral keels enclosing a triangular space; meta-thorax wrinkled transversely, and with a central ridge ending in an obtuse tubercle beyond which it is obliquely truncated, two dorso-lateral tuberosities on the margin of the hinder slope form a triangle with the preceding one, meta-thoracic spiracles oblong. *Wings*, pale fuscous, with the stigma and veins black, the latter becoming paler outwardly; areola present, four-sided, the two transverse cubital nerves bounding its meeting on the radial. *Legs*, coxa of hind legs very large, their femora thickened with a tooth on the lower surface behind the middle, middle and hind tibiæ spurred, and with each two terminal spines, claws stout, simple. *Abdomen*, 1st segment oblique, truncated anteriorly; 2nd, 3rd, 4th, and 5th segments with a lateral impression immediatesy above the spiracles extending backwards and outwards; that of the 5th obsolete beyond the base; immediately above this impression, and in front of the white lateral spot on the 2nd, 3rd, and 4th segments is a small tympanum-like spot (*lunula* of Foerster), round on the 2nd segment, oblong on the others; hind border of segments 6 and 7 with deep-rounded excavation extending forwards half the length. *Ovipositor*, $\frac{1}{4}$th length of abdomen. Length (excl. ovipositor) 17 mm.; wing expansion, 28 mm. *Male*: Smaller, five abdominal segments white-spotted, 1st having two on each side (therefore lateral series 6 instead of 4 as in female). Vertex except sides, and occiput except orbital border of eyes; sides of scutellum, and frenum black; scutellum and frenum with raised yellow border.

Exephanes leucaniæ, sp. nov. (Ichneumonidæ.) Plate 77, Fig. 3.)—This ichneumon is a dark-coloured insect, measuring about $\frac{1}{2}$th inch long, having a long band on the hind body; the feelers and legs red;

also several white spots on the thorax present. With regard to it, it may be affirmed that observations point to the conclusion that it does not occur in such numbers as do the other hymenopterous parasites described, but still it was met with on the Darling Downs in such numbers as to indicate that considerable services in checking the increase of the caterpillar moth was being exerted by it. With reference to its movements, it may be stated that it is a far less active insect than is the more prevalent Red Theronia. Only male examples have been reared from victimised caterpillars; but its systematic relations are sufficient evidence that its consort will prove to have a relatively short ovipositor. Probably not more than a single *Exephanes* grub reaches maturity within the body of its caterpillar host. No species of *Exephanes* existing in Australia appears to have been hitherto described. It may be thus characterised:—

Male. Exephanes leucaniæ, sp. nov. Black; antennæ (except two basal joints), labial palps, legs (except coxæ and trochanters of all and special bands on hind legs), 2nd abdominal segment, and 3rd beneath, basal ⅔ of costa and stigma of forewings horn-yellow to red; front and clypeus (except a triangular patch in the centre), anterior surface of basal joint of antennæ, prothorax above, scutellum, a spot on each side of metathorax behind, two spots at root of forewing, a large spot on the inner aspect of the trochanter of each leg, a lateral spot at the extremity of the 1st joint of the abdomen, pale yellow; hind border of 3rd abdominal segment, wide band on hind border of 4th, and 5th on each side (bands not meeting above) and hind border of 6th, white. Antennæ fuscous towards extremities; tarsi (except proximal ⅓rds of 1st joint), a broad band at extremity of both tibia and femur of hindlegs black. Entire surface thimble-punctured, frenum and metathorax above rugose; for the most part covered with fine whitish hair. Lower surface of abdomen glossy, otherwise dull. *Thorax* with scutellum evenly convex, separated from mesothorax by a wide smooth sulcus closed on each side by a sharp keel, that borders the mesothorax laterally; metathorax with rounded antero-posterior contour, with a sudden posterior declivity, and with four smooth longitudinal keels proceeding backwards from foreborder, the two lateral ones just above the slit-like spiracles becoming soon obsolete, the two dorsal ones united to the foregoing by transverse keels extending some way down hinder declivity; the latter also enclose a space that is divided into three areas by transverse keels, whereof the anterior one widens in front, and the middle one is square. *Abdomen,* petiole of 1st joint with a low narrow keel on each side beneath, and a dorsal one on each side above the spiracle; 2nd segment with large wrinkled depression on each side adjacent to the fore-border. *Wings* with areola well-marked, the transverse cubital veins, forming it, separated at origin on radial. Discoidal transverse, or 2nd recurrent, with a projection outwards in the middle of its length, a projection inwards also at origin of cubital vein; veins of forewing (except costa and stigma), blackish. Length, 15 mm.; expanse of wings, 23 mm.

3. *Paniscus* (*productus,* Brullé?). [Fam. Ophionoidæ.] (Plate 77, Fig. 4.) This is a large yellowish-brown clear-winged insect, having the hinder body, that is usually held in an arched position, compressed from side to side and widened towards its extremity. It measures nearly 1 inch in length, and has a wing expansion of 1¼ inches. Unlike the first-mentioned ichneumon, the sexes in this are much alike. However, the female has a short ovipositor that is not, however, always exserted. It also differs from it insomuch as the *Paniscus* grub is not an internal feeder, although when the caterpillar transforms into a chrysalis it becomes enclosed therein, though covered subsequently by its own special cocoon. It also has a comparatively slow flight, and does not dash hither and thither when on the wing, and in alighting it seems to do so with some hesitation. In attacking a caterpillar it fastens its dark-coloured eggs on the surface near the head. These eggs are pedunculated or stalked, and are attached by these stalks being inserted through and beneath the skin of the victim, this being in the first instance punctured by the parent ichneumon for the purpose. In feeding, the ichneumon grub does not wholly leave the egg-shell whence it has emanated, and ultimately this remains fixed to it at one end.

Only a single ichneumon grub appears to mature in each chrysalis. These brown ichneumons were of very common occurrence amongst the *Leucania* caterpillars met with on the Darling Downs and elsewhere.

Brullé (Lepelletier de Saint Fargeau's "*Histoire naturelle des Insectes Hymenopteres,*" IV., p. 156) described in 1846, an Australian species of *Paniscus*, but it does not appear that the present insect is identical with the one noticed by him. The following technical description will serve to distinguish the latter:—

Female.—Yellowish brown, spot on vertex including ocelli, scabbard of ovipositor and claws of feet black; posterior orbital band yellowish; legs passing outwardly to pale testaceous; finely punctured and for the most part clothed with appressed pale-coloured pubescence, a few stronger hairs on fore-border of clypeus. *Head*, depression containing antennary fossæ not divided. *Thorax*, scutellum with disc bounded by straight posteriorly approaching keels; metathorax transversely wrinkled, without distinct surface areas, fore-border roundly excavated, the excavation being bounded by a ridge. *Abdomen*, 1st joint with spiracles long before middle; ovipositor comparatively well developed, measuring when exserted nearly as long as first body segment; hairy divisions of scabbard curved upwards at origin. *Wings* with dark-brown veins and brownish-yellow stigma, areola present, 2nd recurrent (discoido-cubital transverse) continuous with outer cubital transverse, veins interrupted by—usually oval—clear glabrous spaces having the following disposition, one in the middle of 1st abscissa (present) of cubital, one in the outer cubital transverse, two in the 2nd recurrent (discoido-cubital), and one in the discoidal—between origin of sub-discoidal and posterior margin. *Claws* with comb-like teeth—as in other Ophionoidæ. Total length, 20 mm.; expanse wings, 17 mm.; hind legs, 20 mm.

Male.—Smaller, with abdomen more slender, and less wide at extremity. The face is either yellow, or much paler coloured than remainder of body; last abdominal segment represented by two oblong valves instead of a single sheathing scale.

4. *Apanteles ruficrus*, Haliday. [Braconidæ.] (Plate 77, Figs. 5, 5*a-b*.) This is a minute insect, measuring about 1¼ lines long, with a wing expansion of 2½ lines. It is black in colour, with pale yellowish brown legs (the first joint of the hindmost pair being black), and four clear wings. It is best known from its cocoons, that are small, white, oblong bodies measuring each about 2¼ lines in length. They occur side by side, fastened together, by the loose silk that surrounds each, in masses of 50 or 60 together, and are commonly met with attached to the stalks of grain where caterpillars occur. Those whose observations have brought them to light have, however, invariably regarded them as "caterpillar's eggs" meet for destruction. The female insect may, moreover, by close attention, be detected moving at the base of the herbage that is being devoured in quest of its prey, often running for this purpose over the ground. Having found a caterpillar, the *Apanteles* probes it with its ovipositor, and so inserts into its tissue its own tiny eggs by the score. The resulting larvæ feed upon the "juices" of their victim, and so gradually effect its destruction. This is accomplished, however, before the chrysalis stage is reached. The approach of death is heralded by a general torpidity and sluggishness in the movement of the caterpillar, which may, however, crawl aimlessly to exposed situations. But, meanwhile, the young of the parasite which infest it, after raising minute rounded swellings upon its surface opposite where they individually occur, pierce its skin, and immediately on issuing spin their cocoons; and when this has been accomplished, nothing but a shrivelled and darkened skin remains to represent their host.

The Queensland insect appears to be identical with *Apanteles ruficrus* of Haliday, as is seen on comparing it with the very full description of the latter given by Rev. T. A. Marshall [*vid.* Species des Hyménoptères D'Europe. Les Braconides, Vol. I., page 410 (1888)]. This insect, according to the latter authority, occurs in Europe in parasitic relation with no less than seven distinct species of caterpillar, amongst which are included two species of *Leucania*—*i.e.*, the genus to which our present pest belongs.

This parasite is generally very efficacious in destroying the *Leucania* during the caterpillar phase of its existence. It is, however, itself in turn often preyed upon by a still smaller hymenopteron. This is a bronzy-black insect, measuring about 1 line in length, and is a chalcid-id fly apparently belonging to the genus *Dibrachys*. The *Dibrachys* however, does not appear to attack it until it has accomplished, for a season, its useful work. It may, nevertheless, occur in such numbers as to render the *Apanteles* locally scarce for some considerable time. In the ordinary course of events, each little cocoon in the mass opens at the top by a little cap-like lid as if it had been cut across at this spot, and so the primary parasite emerges. But when the *Dibrachys* has attacked it, the end remains closed, and a small round opening eventually occurs in its wall.

5. *Linnæmyia migripalpus*, n. s. [Fam. Tachinidæ.] (Plate 77, Fig. 6.) This insect, that resembles in general appearance a Meat Fly (*Sarcophaga*), or large house-fly, is very serviceable in preventing the transformations of the caterpillars to egg-laying moths. Where its victims occur, it may frequently be observed slowly wending its way amongst the wheat stalks and constantly settling thereon. It measures, as a rule, about $\frac{5}{12}$ inch in length, and is of a greyish colour, has an ashy white face, a dark-striped thorax, more or less pale brown upon the hind body, and brownish-yellow legs with black feet. It is, moreover, clothed with numerous stout black bristles and stiff hairs. Its habit is to glue one or more of its numerous eggs to the surface of the body of the caterpillar it attacks. These, on hatching, produce tiny maggots that bore their way into the tissue of their host, and feed thereon until fully developed; and then, without fabricating any special covering, they transform into pupæ within their own hardened, discoloured skins, becoming smooth, dar-brown or nearly black, cylindrical, objects with rounded ends.

The caterpillar has meanwhile entered the soil and become a chrysalis, though it would appear that sometimes the victim is not able to reach this degree of development. In the latter event the pupæ of the parasite are exposed in the soil instead of remaining within the protecting covering otherwise available.

The period that elapses between the attachment of the egg of the Tachinid parasite to the caterpillar and the appearance of the fly is about three weeks; but this is subject to variation as the result of special climatic and other conditions.

The percentage of caterpillars victimised by this fly, in any of the occurrences of this grass-marauder that have been observed in Queensland, has not been estimated. There are, however, grounds for concluding that in some instances it is very large.*

The following description will serve to identify this parasite:—

Linnæmyia nigripalpus, sp. nov.—*Head* with frontal vitta wax-yellow coloured; face, cheeks greyish white; 2nd joint of antennæ grey above; "beard" white. Head narrower at level of vibrissæ than at origin of antennæ. Two stout macrochetæ on vertex behind ocelli, orbital bristles present; three smaller bristles above vibrissæ,

* Related Tachinid parasites of *Leucania unipuncta* have been met with in other countries. Thus F. M. Van Der Wulp has described, as occurring in British India, a Tachinid parasite of *Leucania extranea*, Guen. (synonymous with the *Leucania* under notice), with the designation *Masicera castanea* (Indian Museum Notes, III., page 12, 1894), from which the present insect differs by marked structural features —the minute palpi and hairy eyes, amongst others. D. W. Coquillet has also recorded three related parasites as victimising *Leucania unipuncta*, Haw., in North America:— *Belvosia unifasciata*, Dsv.; *Phorocera leucaniæ*, Coq.; and *Winthemia 4-pustulata*, Falv. (Tech. Ser. 7, Div. Ent. U.S. Dep. Ag.)

which latter are situated above level of the oval margin; sides of face bare. Antennæ fuscous, 2nd joint rather less than ½ third, 3rd joint compressed, extremity truncated and widened, upper edge concave; arista thickened gradually, tapering to a point, basal joints well developed. Eyes with pale hairs. Proboscis black at base, suctorial portion brown. Palpi minute black, with a terminal long black hair. *Thorax* grey with four dorsal longitudinal narrow black bands, not extending to scutellum, with three post sutural macrochetæ (above base of wing) and three sternopleural ones; scutellum with four pairs of marginal macrochetæ, central ones smaller. *Abdomen* elongate, testaceous-brown; the centre of the back occupied by a broad black band that widens generally posteriorly (so as to occupy greater part of width of 4th), and, moreover, expands towards the posterior border of each segment; venter with a central black spot on each, and an additional lateral one on each side of the 4th and 5th segments; 2nd abdominal segment with two and 3rd segment with six macrochetæ on posterior border; those on 4th nearly hidden by long bristles. *Legs* testaceous-yellow, rounded spot at base, and elongated spot at extremity, and tarsi black; pulvillus of foot white. *Wings* with 1st longitudinal vein bare, 4th longitudinal reaching fore-border rather less than half-way from tip of 2nd to apex; small cross vein opposite middle of discal cell. *Tegulæ* white. **Length, 12 mm.**

B.—Predaceous Insects.

In addition to the true parasites of the *Leucania* caterpillars, there are other insects belonging to Beetle (*Coleoptera*), Bug (*Hemiptera*), and other families that prey upon them, and either suck out the fluid contents of their bodies or consume their tissues.

Amongst these the most conspicuous, although not the most prevalent, is a large beetle belonging to the family Carabidæ, and named *Calosoma australis*, Hope. This beetle may attain a length of an inch, and maximum breadth of half-an-inch. It is nearly black beneath, but its upper surface is of a brilliant dark-green colour, and its wing-covers are striated with numerous punctured lines. These features, as well as its general form, are represented in Fig. 1 of Plate 77.

The *Calosoma* beetle runs over the surface of the ground in quest of its prey, but its secluded habits and activity, as well as the fact of its being for the most part nocturnal, prevent its being observed as frequently as might otherwise happen. It is, however, a voracious feeder, seizing its victim in the first instance in its formidable jaws, and no doubt renders considerable service.

C.—Birds.

Allusion has already been made to the service performed by birds in limiting the numbers in which these caterpillars occur. When a visitation of caterpillar hordes is being experienced, native birds, as a rule, are not numerically sufficiently strong to accomplish very noticeable benefit. It is, however, during seasons in which these marauders do not assert their destructive capabilities that the useful work of these friends of the farmer is performed. At these times they largely contribute to maintain the numbers in which these insects occur within safe limits. Amongst them may be specially mentioned, not only such birds as Laughing Jackasses (*Dacelo gigas*), the Pied Crow Shrike (*Strepera graculina*), the Magpie (*Gymnorhina tibicen*), Butcher Birds (*Cracticus spp.*), Magpie Larks (*Grallina picata*), the Mutton Bird (*Corcorax melanorhamphus*), the Crow (*Corvus australis*), the Curlew (*Edicnemus grallarius*), the Plover (*Lobivanellus lobabus*), but also the smaller Fly Catchers proper, not excepting even the diminutive Blue and Red-backed "Wrens" (*Malurus spp.*). There are, however, some birds that accomplish even greater work than these, and reduce the numbers of the caterpillars to a very appreciable extent when they occur in the myriads that are sometimes encountered. The Straw-necked and White Ibises are especially alluded to in this connection. These not only feed over

PLATE 75.—WHEAT: HEAD OF STOOL SHOWING INJURY BY CATERPILLAR.

the grass lands in flocks of thousands, but visit the cultivated lands, should the crops be not too high, in immense numbers also. And when the caterpillars have gone into the soil to pupate, they will even search for them with success with their long beaks, probing the earth in all directions.

D.—Disease.

The consideration of the subject of disease in caterpillars—caused by either bacteria or by fungus germs, and its possible propagation by artificial means—is postponed.

REMEDIES.

1. The effectual exhibition of remedial measures implies a prompt recognition of the presence of the caterpillars. As a rule they may be long present in a growing crop and yet escape observation, simply because their injuries are not sufficiently pronounced to betray their occurrence. It is, therefore, expedient that the farmer inspect from time to time his growing crop, especially early in August and February, and pull up here and there some of the ranker growing clumps or stools, and shake these well with a view to discovering the immature caterpillars—pale miniatures of the pest as ordinarily perceived. This remark is prompted by the experience, that usually it is not until the caterpillar is full-grown and has almost completed, not only the first phase of its existence, but also all the injury that it is capable of inflicting, that measures of repression are sought out.

2. Moreover, as it often happens (though the reverse may occur) that the whole area of a plot in crop is not simultaneously attacked, but different parts are visited successively, it will be found generally practicable to isolate the earlier infested portions, if narrow roads be left intersecting the area under cultivation, to contain ditches or furrows that may be ploughed or dug along them.

3. Although generally it is expedient to sow early and raise a quickly maturing crop in view of the probability that rust may assert its presence, it is expedient, having regard to the probable occurrence of caterpillars, to so arrange the time for sowing that the plants constituting the crop will not be sufficiently advanced at the time that the moths are about to afford a suitable location for their eggs. And in deciding the probability of such an occurrence it is necessary to note two things:—1st, the extent to which the caterpillars and chrysalises constituting the immediately previous infestation have been victimised by parasites; and 2nd, the degree of prevalence of the parent moths. The former may be generally inferred by the comparative numbers in which moths visit the lights in the house after nightfall; and the latter by submitting uninjured chrysalises, in earth, to the Department for examination. It must be added, however, that, though June is probably the best month to sow on the Darling Downs some cereals (*e.g.*, oats), still, owing to the dryness that generally prevails then, germination may not take place.

4. When caterpillars are early perceived in the young growth it will be often expedient to feed it off with sheep or cattle. The trampling of stock is very fatal to pests of this description, and the act of feeding on the part of cattle also destroys them, even where they are not killed by exposure and by partial deprivation of sustenance.

A similar result may be accomplished by passing a heavy roller over the land, as, having soft bodies, they are quite readily injured; but this procedure, as also the preceding, can only be successfully

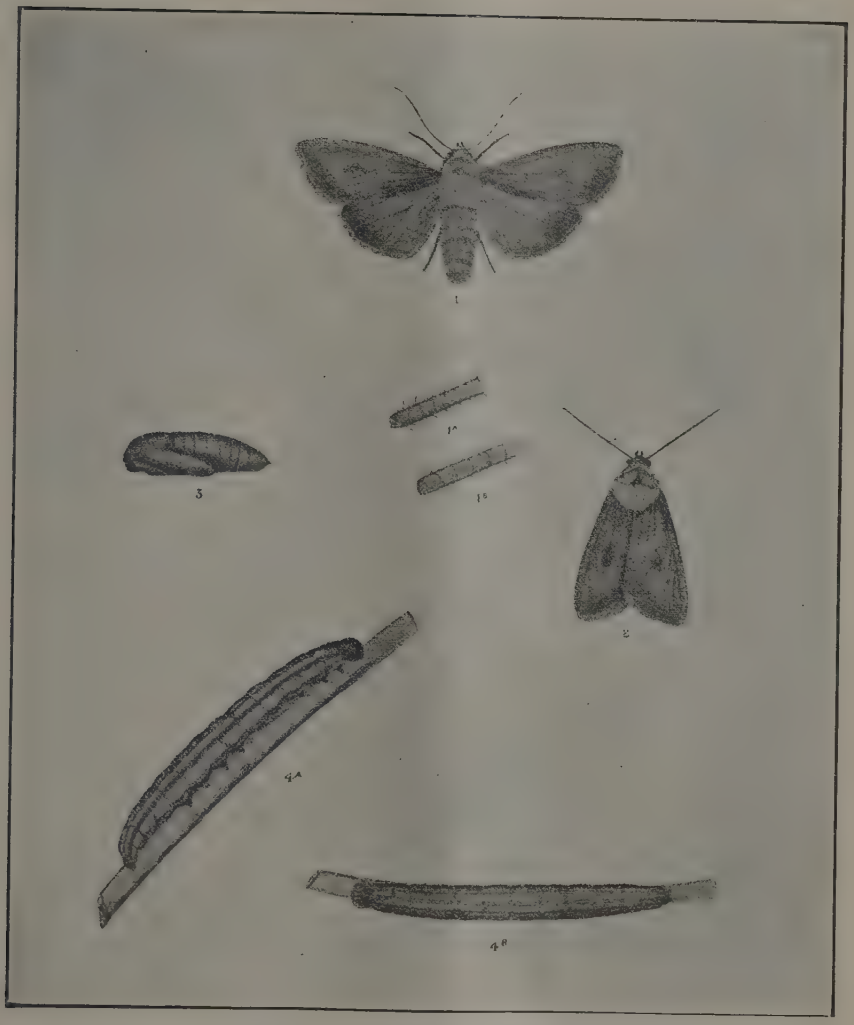

PLATE 76.—*Leucania unipuncta*, Haw.

resorted to when the growth is quite short. The use of a roller, under these circumstances, will be especially serviceable when the ground is firm and smooth. The presence of a strong stubble, in the case of a second growth of green fodder having to be dealt with, will, of course, too, interfere with its use. A roller, moreover, cannot be advantageously employed at times when it would quickly become covered with adherent soil, for this would produce results somewhat similar to what would be attained were the surface naturally uneven.

5. Poisoning caterpillars in the developing wheat or barley crop, at a time when much leaf for them to consume occurs is not advised. To be efficacious then an application to the entire foliage would be necessitated. Even were it expedient in the face of other objections, we have not at present in Queensland the appliances for treating large areas, such as are the Strawsonizer and its more modern representatives. Poisoning, however, is a valuable procedure, when already much of the flag has been consumed, and the heads of grain are advanced in growth and threatened with attack. The poison then favoured is the ordinary Cut-worm Bait. This is not a fluid but a mixture composed of an arsenic salt (such as Paris Green, Arsenate of Lead, ordinary Arsenic Arsenious Acid, or Arsenite of Soda), as the essential ingredient; bran or middlings and bran in equal amounts, as the medium, and molasses or sugar for the attractant. The two first are to be mixed in the proportion of 1 lb. to 30 lb. (even up to 50 lb.), and the mixture moistened with sugar and water in the proportion of $\frac{1}{4}$ lb. to 1 gallon (or molasses 4 lb.). It is found in our practice preferable to slightly moisten the medium before adding the poison, since owing to its density it cannot well be evenly mixed with a dry medium. The mixture, again, should be not rendered wet, but moist enough for the bran, &c., whilst cohering to run through one's fingers. This bait should be broadcasted over the surface through the crop, before nightfall when the caterpillars principally feed. Injury to standing wheat, in moving in it through and through, limits the use of this procedure in its case.*

6. In many cases, as previously suggested, fields owe their visitation of caterpillars not to the fact that the moths have earlier deposited their eggs on the plants constituting the crops growing thereon that are the object of attack, but, on the other hand, to migration of caterpillars from adjacent ones. The same remark applies also to different plots in the same field. That this has been the case has been shown in many instances, in the course of this investigation. It becomes, therefore, expedient to adopt measures to protect the still unvisited cereal or grass crops. This may be effected by the adoption of one or other of the following measures:—Surround the infested area with a ditch or furrow. If the ground be loose or rubbly in accomplishing this, plough in succession two or more furrows, as deep as practicable, with a double mouldboard plough, making the sides as loose as possible by dragging brush

* Mr. L. Redwood, Toowoomba, has laid stress on the efficacy of the Poison Bait when barley is being attacked and it has reached the stage of growth when it is turning a golden yellow, the flag is down, and the heads are about to be cut off by the caterpillars, now very hungry. He uses as a mixture:—1 bushel of wheat bran, 1 lb. arsenic, or its equivalent of Paris Green, sweetening with sugar syrup (preferable to molasses), until the taste of the poison is masked. He also advocates adding a green analine dye to the sweetening fluid when Paris Green is not used. He lays great stress on thorough mixing. He does this first when the ingredients are dry, using a shovel and mixing floor; then with further mixing, adds the sweetening with a sprayer or watering-can, until the necessary moist condition is reached. This bait should be preferably made in the morning and used late in the afternoon; the poison thoroughly impregnating it meanwhile. A bait so made and employed he has found quite deadly to the caterpillars and serving to enable a harvest to be secured that would otherwise be sacrificed.]

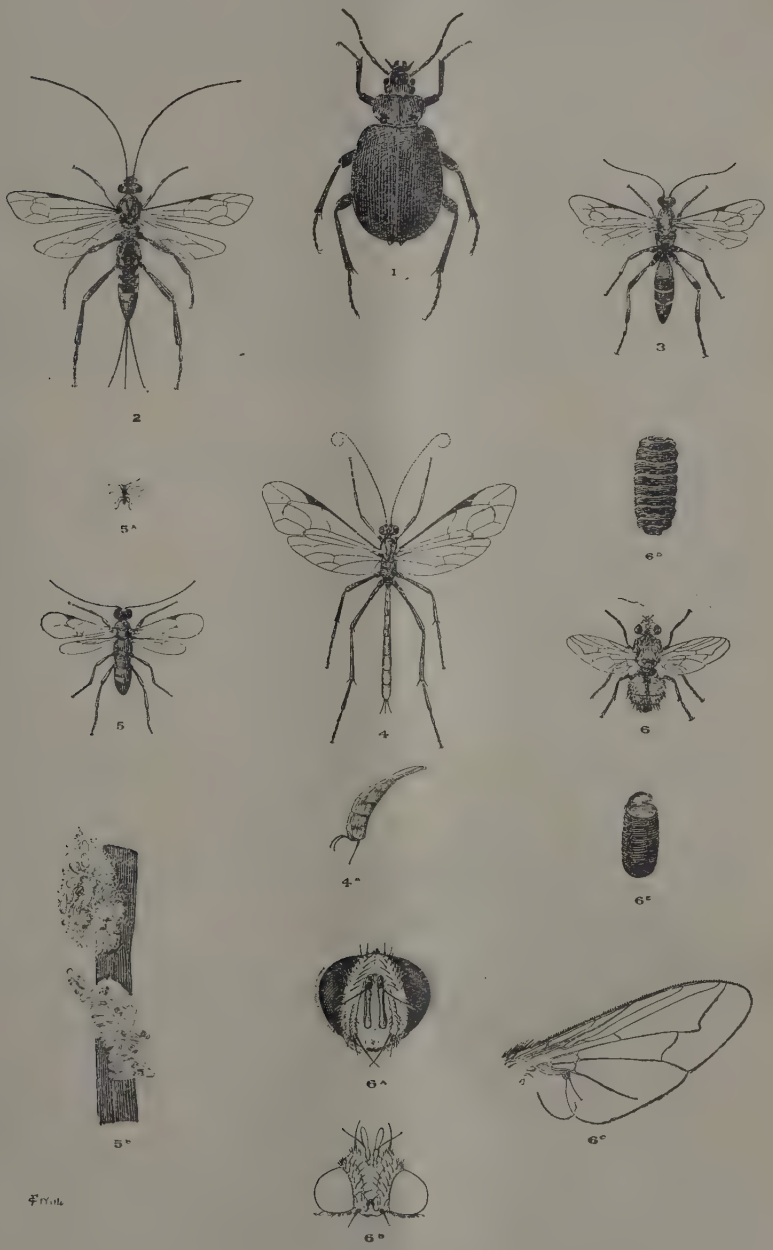

PLATE 77.—NATURAL ENEMIES OF *Leucania Unipuncta*, Haw.

along it. Moreover, should coal tar or gas lime be sprinkled along one of these, a still more effectual barrier will be secured. When the soil is, on the other hand, not loose, but sufficiently firm to allow of one side of the furrow remaining perpendicular or even overhanging, a standing crop, under the circumstances alluded to, may be protected by constructing a special form of ditch such as is described in the following quotation:—"The worms [writes the late Dr. C. V. Riley] may be prevented, as a general thing, from passing from one field to another by judicious ditching. It is important, however, that the ditch should be made so that the side towards the field to be protected be dug under. About every three or four rods a deep hole in the ditch should be made, in which the worms will collect, so that they can be killed by covering them with earth and pressing it down. They may also be destroyed by burning straw over them—the fire not only killing the worms but rendering the ditch friable and more efficient in preventing their ascent" (*Report Commissioner of Agriculture*, U.S.A., 1882, page 96). The holes in the ditches alluded to trap the caterpillars as they wend their way along the bottom of the ditch in their effort to pursue their onward march to pastures new; and when in these an ordinary rammer will despatch them.

Experiments on my part have shown that the caterpillar will not eat fodder that has been moistened with a comparatively weak solution of either iron sulphate or copper sulphate (bluestone), even after such fodder has been subsequently dried off; or, if it does so—as may happen when the former of these reagents has been used—only sparingly so, and with apparent reluctance. It may, therefore, prove advantageous, by way of protecting plant growth, to spray it with one or other of these solutions. The necessity for protecting young maize plants from caterpillars travelling from an adjacent field of wheat, oats, or other cereal seems to afford an instance in which this procedure might be not only practicable but also successful. However, the possible injury to the plant from the use of too strong solutions must be anticipated.

Again, with a like object in view it will often be found profitable to poison a broad strip of herbage immediately in advance of a travelling host of caterpillars. Paris Green or London Purple may be used for this purpose. [If the former be employed, that bearing the brand of Messrs. Blundell and Spence, and sold in 1-lb. packets, is recommended in preference to other forms of the article on the market, as having a composition fairly uniform.] These poisons may be exhibited either in water or with some dry diluent as a powder. In the former case 1 lb. of Paris Green or ¾-lb. of London Purple, having been first made into a paste, should be mixed with 150 gallons of soapy water to which a like weight of fine lime has been previously added (*i.e.*, at the rate of 1 teaspoonful Paris Green to 1½ gallons water), and the whole wash be kept well stirred whilst being applied. In the latter case it may be mixed with flour, or plaster of Paris, 1 lb. of Paris Green being mixed with 40 to 50 lb. of the former, or 100 lb. of the latter. (*Note.*—Since this was written Arsenate of Lead and Arsenate of Lime have, for most insecticidal purposes, superseded Paris Green and London Purple. In employing the former use the paste in the proportion of 1 lb. to 10 gallons of water, or as a dry application mix the Arsenate of Lead powder, with wood ashes, road dust, cheap flour, or powdered lime.) These poisons, if used dry, should be dusted over the plants, having been first placed in a bag, made of some pervious material that is to be fastened to a pole (two such bags, one at each end of a pole, may be placed across a horse's back, and the animal led over the ground it is

proposed to poison, when the jerking will liberate the poisonous dust). If applied in the form of a wash, the mixture may be distributed by means of a watering cart, or Strawsonizer, or other similar apparatus. When the strip of poisoned fodder has served its purpose, it should be mowed down and burnt, to prevent its being consumed by stock prior to its being rendered innocuous by exposure to successive showers of rain.

7. The fact that the insect hibernates as a caterpillar, and frequently may exist in the egg condition in dry grass and stubble, and, moreover, habitually frequents rank herbage, suggests the expediency not only of maintaining the headlands of fields clean and free from weeds, but also of periodically firing pastures. This should be done even when visitations of caterpillars are not immediately impending, as the insect always exists in these situations in greater or less number, and will, under favouring climatic conditions, the existence of a paucity in the numbers in which its natural enemies occur, or the lessened effectiveness of natural checks, generally multiply to a highly prejudicial extent.

8. Under certain special circumstances the moth may be captured by trap-lanterns, or killed by attractive poisoned sweets. The conditions under which crops are grown in Queensland are, however, such that their use is not likely to be attended with any marked result.

9. The fact of domestic poultry being very partial to insects, and caterpillars especially, might be utilised in repressing these in ordinary seasons; the difficulty that is experienced in getting certain varieties to roam far from their roosts being overcome by the use of transportable fowl-houses, as recommended in the writer's Report on the Grub Pest of Sugar-cane: these houses to be moved over the standing crop when this is but little grown and the caterpillars are still young.

10. Farmers interested in caterpillar repression should make it their business to strenuously oppose the destruction of all insectivorous birds and their eggs; especial allusion being made to such birds as are hereafter mentioned.

Description of Plates.

Plate 75.

Head of Stool of Wheat, as injured by *Leucania* Caterpillars. From photograph by C. J. Wills.

Plate 76.

Fig. 1. *Leucania unipuncta* Moth. Natural size. 1 *a*, portion of antenna of male; 1 *b*, portion of antenna of female. (Magnified representations.)
„ 2. *Leucania unipuncta* Moth. Position of rest.
„ 3. Chrysalis.
„ 4. Caterpillar. Dorsal and lateral views.

(From Drawings by C. J. Wills.)

Plate 77.

Fig. 1. Predaceous Beetle—*Calosoma australis*, Hope.
„ 2. Red Ichneumon—*Theronia rufipes*, n. sp. Female.
„ 3. Banded Ichneumon—*Exephanes leucaniæ*, n. sp. Male.
„ 4. Tawny Ichneumon—*Paniscus* (*productus*, Brullé?). Female.
„ 5. Social Ichneumon—*Apanteles ruficrus*, Haliday (enlarged representation). 5 *a*, Natural size; 5 b, Pupa cocoons.
„ 6. Tachina Fly-parasite—*Linnæmyia nigripalpus*, n. sp. 6 *a* and 6 *b*, Face (magnified representation); 6 *c*, Wing (enlarged representation); 6 *d*, Larva (white in nature); 6*e*, Cocoon from which fly has emerged.

(From Drawings by C. J. Wills.)

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING SEPTEMBER, 1921 AND 1920, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of Years' Records.	Sept., 1921.	Sept., 1920.		Sept.	No. of Years' Records.	Sept., 1921	Sept., 1920.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	0·58	20	1·58	0·21	Nambour	2·48	25	3·71	2·57
Cairns	1·67	39	3·85	1·03	Nanango	1·96	39	1·66	2·47
Cardwell	1·45	49	3·09	2·52	Rockhampton ...	1·31	34	2·08	0·66
Cooktown	0·58	45	0·95	0·91	Woodford	2·15	34	4·32	2·48
Herberton	0·47	34	0·89	0·23					
Ingham	1·14	29	5·19	2·99					
Innisfail	3·56	40	8·80	2·49					
Mossman	1·13	13	2·37	2·04					
Townsville	0·78	50	1·76	1·89	*Darling Downs.*				
					Dalby	1·80	51	1·25	2·34
Central Coast.					Emu Vale	1·90	25	2·82	2·06
					Jimbour	1·66	33	0·63	1·65
Ayr	1·57	34	1·32	0·91	Miles	1·49	36	1·22	2·67
Bowen	0·84	50	1 07	1·07	Stanthorpe ...	2·47	48	2·77	2·99
Charters Towers ...	0·80	39	1·31	0·66	Toowoomba ...	2·24	49	3·04	2·40
Mackay	1·49	50	9·07	1·20	Warwick	1·92	34	1·84	2·29
Proserpine	2·00	18	9·44	2·93					
St. Lawrence ...	1·33	50	2·26	0·93	*Maranoa.*				
South Coast.					Roma	1·61	47	0·64	2·64
Biggenden	1·72	22	2·22	2·61					
Bundaberg	1·84	38	0·35	1·94	*State Farms, &c.*				
Brisbane	2·08	69	2·02	3·43					
Childers	2·03	26	1·34	3·21	Bungeworgorai ...	1·58	7	0·58	1·75
Crohamhurst ...	2·53	25	5·28	3·71	Gatton College ...	1·76	22	1·85	2·54
Esk	2·35	34	1·66	3·24	Gindie	0·90	22	4·64	1·32
Gayndah	1·60	50	0·87	2·67	Hermitage ...	1·68	15	2·28	2·51
Gympie	2·16	51	3·17	2·82	Kairi	0·79	7	...	0·24
Glasshouse M'tains	2·08	13	...	2·77	Sugar Experiment Station, Mackay	1·33	24	...	1·20
Kilkivan	1·74	42	1·77	1·86	Warren	0·75	7	1·40	0·40
Maryborough ...	1·97	50	2·49	2·52					

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for September this year, and for the same period of 1920, having been compiled from telegraphic reports are subject to revision.

GEORGE E. BOND, State Meteorologist.

ARSENICAL POISONING.

BY A. H. CORY, M.R.C.V.S.

The medicinal treatment for arsenical poisoning should be prompt and thorough. In small animals, such as dogs and cats, an emetic is advisable, such as salt and mustard in about 3 oz. of warm water. With horses and cattle, medicine must be given, which forms an insoluble compound with the arsenic.

The following treatment is recommended:—Take about 2 oz. of ordinary washing soda, and dissolve it in about half a pint of water, then add 2 oz. liquor ferri perchlor; a sediment forms, and it is then strained through a piece of fine linen and the sediment collected and mixed in 1 pint of cold water and given as a drench, being repeated every half-hour for at least five or six doses.

Editorial Notes.

Primary Principles of Co-operation.

In this issue the Director of Fruit Culture, Mr. A. H. Benson, discusses some problems of produce disposal for which a solution is being sought by the fruitgrowers of this State, and, incidentally, enters a strong plea for the broadening of co-operative effort by primary producers generally. The development of co-operation is evidence that the farmer is gradually readjusting his point of view to bring within focus the effects modern social and economic changes are having upon his industry, and necessity is compelling him to affiliate with his fellow farmers in order to secure fair returns for his labour and enterprise. The pinch of hard times and market problems, the futility of fighting single-handed trade combinations both on the buying and selling sides, transport difficulties, and excessive operation costs, are the main forcing factors in a general forward move towards wider and intelligent co-operation. The pressure of need is one of the primary principles of joint action. Another is combination on a broad, constructive, sound, economic basis. The first is axiomatic and, in respect to the second, experience teaches that often, in the establishment of co-operative enterprises, business principles are to some extent ignored. The rocky road of rural progress is strewn with the wrecks of associations that were conceived with high hope and started out freighted with lofty purpose and impractical enthusiasm. In any further extension of co-operative enterprise the lessons of the past should be our guide. The sound business way is the only way. No new commercial venture can expect to escape the fierce competition of existing enterprises, directed by keen brains, with which it will inevitably be beset. Brains must be met with brains, and no co-operative concern can expect a full measure of success unless based on modern business principles and economically conducted. These observations, which are almost in the nature of a warning, may be thought unnecessary. In view of a general awakening to the value of combined action by primary producers, they possibly are, for on all sides are signs of the recognition of science and experience as valuable auxiliaries in bringing about better farming, better business methods, and a richer rural life.

General Notes.

PUBLICATIONS RECEIVED.

The Veterinary News (13-8-21) has a very interesting editorial on tuberculosis in cattle and its relation to public health, in the course of which it states: "If the veterinary profession were to inform the public that tuberculosis in cattle was a great danger to human health; that a large percentage of deaths, joint diseases, meningitis, glandular enlargements, tabes mesenterica, &c., were caused by the consumption of milk of tubercular cows; that the care taken in the pasteurisation of milk was not always such that would guarantee the milk being germ-free; that cattle, found to be *tubercular by the tuberculin test were being sold and scattered all over the country (U.K.), more especially by pedigree breeders*; and that cattle and swine were of more importance than human life or health: it would be doing its duty and earning *kudos*. It is said that the country could not afford to stamp out the disease, but the best veterinary experts have informed us that this is not so. It could be stamped out much more cheaply than the costs of erection of expensive plant for the pasteurisation of milk. . . . When tuberculosis endangers the health of the community and takes a high toll of young life, it cannot afford to spend any money in attacking the disease at its root. . . . The country (U.K.) pays more attention to the prevention of diseases of the potato than it does to the prevention of tuberculosis in cattle, and, in consequence, in man. . . . There are a few ultra-selfish dairy farmers and pedigree breeders who, in order to benefit themselves, spread the disease elsewhere without diminishing its total incidence one jot. Tuberculosis should be prevented or eliminated first by eradicating the disease from cattle. That is the paramount duty of the veterinary profession. As to its suppression in man, that becomes the responsibility of the medical profession."

Answers to Correspondents.

DAIRY STOCK.

P. J. Hull (Kaiyera, Cardwell)—

(1.) Using milk for a calf from a cow of another breed will not affect the purity of the calf's breeding in any way. It is possible, however, to seriously mar the dairy quality of any calf bred for production (dairy purposes) by rearing it solely on a plentiful supply of whole milk. In other words, a calf of a dairy breed can be reared *too well*, and in this way encouraged to lay on flesh and fat. Jersey calves, for example, fed solely on an excess of whole milk up to weaning age, say seven or eight months, would have a tendency to alter in type and to become gross, particularly if run on rich pastures. Some of this grossness may be overcome later on by breeding from them younger than is usual, say at the age of fifteen months.

(2.) Quantity of whole milk required daily for a calf—One gallon constitutes an ample ration, even for a well-grown calf, a younger animal requiring slightly less. It is not known whether you purpose continuing to rear the Jersey calves on other cows, but, if the latter are fairly good milkers, one cow should rear two calves.

(3.) The practice of thoroughly quietening the calves by tying them up at night, using a strap round the neck, and a length of chain with a swivel on it, will do much to keep them quiet and tractable. This system is certainly to be preferred to allowing the calf to run at large with a foster-mother.

(4.) Your pure-bred Jersey bull may be used for all classes of healthy animals, without detriment to the purebreds.

(5.) We have no special pamphlets on the subject of the feeding of dairy cows and calves, other than the pamphlet on feeding whey, which is being forwarded to you. This is merely sent for reference purposes, as it is known you are not cheesemaking.

(6.) Details of certain rations for dairy cows are being forwarded. These may not be exactly applicable to your case, but will serve as a guide as to the quantities of respective foods required when an animal has to depend solely on foods supplied.

ENTERITIS—A POULTRY DISEASE.

H.L. (Reid's Creek, Gayndah)—The Poultry Expert, Mr. J. Beard, advises as follows:—

"Now that the hot weather is again with us it would be wise for all poultry-keepers to be on the alert and avoid, if possible, the introduction of this serious disease. *Causes.*—Stimulating foods, over-feeding, irritating vegetable and mineral poisons, drastic purgatives, unclean water, the presence of unslacked lime, continuous feeding of house scraps or sloppy foods which have a tendency to become sour and contaminated. The disease, when due to any or several of the foregoing causes, is generally confined to individual birds, but if it becomes contagious it spreads rapidly through the flock. Heavy mortality is a consequence. *Symptoms.*—Listlessness, closure of eyes, ruffled plumage, continual trembling, restlessness, shanks lose lustre and shrivel, bilious-looking excreta. *Treatment.*—Quarantine affected birds in a clean warm coop, administer two teaspoonfuls of castor oil to each; two hours later give to each ten drops of chlorodyne on a piece of bread. Should the excreta not harden in from six to eight hours, give another five drops of chlorodyne in the same way, and continue until a cure is effected. Feed on soft food such as bread and milk or boiled rice. Treatment should be commenced as soon as symptoms are noticed. Houses and runs must be thoroughly cleaned and disinfected. All rubbish and dirt should be burnt. Remove droppings every day and burn them, as they contain germs of the disease. *Prevention.*—Cut a kerosene tin in half, end up, place therein clean drinking water to which has been added one tablespoonful of kerosene. The oil spreads over the surface, and the birds get a little every time they drink. This practice should be carried out every third day during a threatened attack. All other water should be kept out of reach. This is also a certain cure in case of slight colds or roup of any kind, providing the gills and nostrils are washed out and dried."

Farm and Garden Notes for December.

Although November is regarded generally as the best period for planting the main maize crop, on account of the tasselling period harmonising later on with the summer rains, December planting may be carried out in districts were early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of silage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resistant. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state, consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum when in head, in the proportion of one-third of the former to two-thirds of the latter, a well balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not available and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary, otherwise considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton sown in October and November will be making great headway, owing to the September and October rains. Keep down all weed growth by scarifying as long as the growth will admit of horse work. Tree cottons, such as Sea Island and Caravonica, should be topped and pruned.

Kitchen Garden.—Gather cucumbers, melons, vegetable marrows, and French beans as soon as they are fit for use. Even if they are not required, still they should be gathered, otherwise the plants will leave off bearing. Seeds of all these may be sown for a succession. Tomatoes should be in full bearing, and the plants should be securely trained on trellises or stakes. Where there is an unlimited supply of water, and where shade can be provided, lettuce and other salad plants may still be sown. All vacant ground should be well manured and dug two spits deep. Manure and dig as the crops come off, and the land will be ready for use after the first shower.

Flower Garden.—Keep the surface of the land well stirred. Do not always stir to the same depth, otherwise you are liable to form a "hard pan," or caked surface, beneath the loose soil. Alternate light with deep hoeings. A few annuals may still be planted, such as balsams, calendulas, cosmos, coreopsis, marigold, nasturtium, portulaca, zinnia and cockscomb. Plant out whatever amaranthus may be ready. These may still be sown in boxes. Clear away all annuals which have done flowering. Bulbs should have all the dead leaves cut away, but the green leaves should not be touched. Stake chrysanthemums, and, as the flower buds develop, give them weak liquid manure. Coleus may now be planted and propagated from cuttings. Dahlias are in various stages, but the greater part will have been planted by this time. Give them liquid manure, and never let them dry up. Lift narcissus about the end of the year, but do not store them. Plant them out at once in their new positions. Top-dress all lawns.

Orchard Notes for December.

THE COAST DISTRICTS.

The planting of pineapples and bananas can be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple-growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime-sulphur, potassium, or sodium sulphide washes. Borers should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and melons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Early ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as

possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground for fruit fly and codling moth, as well as of fungi, such as those producing the brown and ripe rots. Early ripening fruits should, therefore, be carefully graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste. It is better to get a good price for half the crop and destroy the balance than to rush the whole on to the market and get little or nothing for it.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codling moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Vegetables will require constant attention in the Granite Belt area. Tomatoes and potatoes will require to be carefully watched in order to prevent loss from Irish blight, and no time should be lost in spraying these crops should this disease make its appearance in any part of the district, as it can be prevented by spraying with either Bordeaux or Burgundy mixture. These fungicides effectually protect the plants to which they are applied if used in time. If leaf-eating insects, such as beetles, grasshoppers, and caterpillars, are doing damage as well, add 3 or 4 lb. of arsenate of lead to the 100 gall. of spraying mixture used for the prevention of early and late blight (potato macrosporium and Irish blight), so that the one application will be effectual for both classes of diseases.

Keep all kinds of vegetables well worked, stirring the land frequently to retain moisture, and taking care to prevent the formation of a surface crust should rain take place. Remember that vegetables require plenty of moisture; therefore leave nothing to chance, but do your best to retain all the moisture in the soil you possibly can.

CAPE WEED.

Lackey and Sons (Summit)—Your letter and the specimen forwarded were referred to the Government Botanist, Mr. C. T. White, who advises as follows:—

"The specimen forwarded is the Cape Weed (*Cryptostemma Calendulacea*), a native of South Africa and a naturalised weed in practically all the Australian States. It is much more abundant in New South Wales and Victoria than in Queensland, and in those States is regarded as a most aggressive and noxious weed. It has, however, a certain food value for stock, though when it dies down it presents a somewhat woolly mass, and may cause impaction in animals feeding on it."

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT BRISBANE.

1921.	SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
Date.	Rises.	Sets.	Rises	Sets.	Rises.	Sets.	Rises.	Sets.
1	5·3	5·33	5·29	5·47	4·59	6·5	4·46	6·28
2	6·2	5·34	6·28	5·48	4·58	6·6	4·46	6·28
3	6·1	5·31	5·27	5·48	4·57	6·7	4·46	6·29
4	6·0	5·35	5·26	5·49	4·56	6·7	4·46	6·30
5	5·59	5·35	5·25	5·49	4·56	6·8	4·46	6·31
6	5·58	5·36	5·24	5·50	4·55	6·9	4·46	6·31
7	5·57	5·36	5·23	5·50	4·54	6·9	4·46	6·32
8	5·56	5·37	5·21	5·51	4·53	6·10	4·46	6·33
9	5·54	5·37	5·20	5·51	4·53	6·11	4·46	6·33
10	5·53	5·37	5·19	5·52	4·52	6·11	4·47	6·34
11	5·52	5·38	5·18	5·52	4·52	6·12	4·47	6·35
12	5·51	5·38	5·17	5·53	4·51	6·13	4·47	6·36
13	5·50	5·39	5·16	5·53	4·51	3·14	4·47	6·36
14	5·49	5·39	5·15	5·54	4·50	6·14	4·48	6·37
15	5·48	5·40	5·14	5·54	4·50	6·15	4·48	6·37
16	5·46	5·40	5·13	5·55	4·49	6·16	4·48	6·38
17	5·45	5·41	5·12	5·56	4·49	6·17	4·48	6·39
18	5·44	5·41	5·11	5·56	4·49	6·17	4·49	6·39
19	5·43	5·42	5·10	5·57	4·48	6·18	4·49	6·40
20	5·42	5·42	5·9	5·57	4·48	6·19	4·50	6·40
21	5·41	5·42	5·8	5·58	4·47	6·20	4·50	6·41
22	5·40	5·43	5·7	5·58	4·47	6·21	4·51	6·42
23	5·38	5·43	5·6	5·59	4·47	6·22	4·51	6·42
24	5·37	5·44	5·5	6·0	4·47	6·23	4·52	6·43
25	5·36	5·44	5·4	6·0	4·47	6·24	4·52	6·43
26	5·35	5·45	5·4	6·1	4·46	6·25	4·53	6·43
27	5·34	5·45	5·3	6·2	4·46	6·25	4·53	6·44
28	5·33	5·46	5·2	6·2	4·46	6·26	4·54	6·44
29	5·32	5·46	5·1	6·3	4·46	6·27	4·55	6·44
30	5·30	5·47	5·0	6·4	4·46	6·27	4·56	6·45
31	...	...	4·59	6·5	...	...	4·57	6·45

PHASES OF THE MOON, ECLIPSES, &c.

(The times stated are for Queensland New South Wales, and Victoria, where the clock time is identical).

		H. M.
2 Sept.	● New Moon	1 33 p.m.
9 „	☾ First Quarter	1 30 p.m.
17 „	○ Full Moon	5 20 p.m.
25 „	☽ Last Quarter	7 18 a.m.

Apogee on 14th at 6·0 a.m.
Perigee on 29th at 11·48 p.m.

1 Oct.	● New Moon	10 26 p.m.
9 „	☾ First Quarter	6 12 a.m.
17 „	○ Full Moon	9 0 a.m.
24 „	☽ Last Quarter	2 32 p.m.
31 „	● New Moon	9 39 a.m.

Apogee on 11th at 8·54 p.m.
Perigee on 27th at 4·30 p.m.

8 Nov.	☾ First Quarter	1 54 a.m.
15 „	○ Full Moon	11 39 p.m.
22 „	☽ Last Quarter	9 41 p.m.
29 „	● New Moon	11 26 p.m.

Apogee on 8th at 6·12 a.m.
Perigee on 21st at 7·54 p.m.

7 Dec.	☾ First Quarter	11 20 p.m.
15 „	○ Full Moon	12 50 p.m.
22 „	☽ Last Quarter	5 54 a.m.
29 „	● New Moon	3 39 p.m.

Apogee on 6th at 1·12 p.m.
Perigee on 18th at 7·36 a.m.

A Total Eclipse of the Sun will occur on 1st October, visible in the South Polar Region and up to a few miles south of Cape Horn.

As a partial eclipse it will be visible in the lower part of South America, but not in Africa or Australia.

The Moon will be eclipsed by the Earth almost totally on 17th October, about 9 o'clock in the morning, when it will be below the horizon in Australia.

As Mercury will be at its greatest distance east of the Sun on 8th October, it should be visible in the west soon after sunset for a fortnight or more. On the 3rd it will be to the left of the Moon, and Venus and Mars will be remarkably in juxtaposition before sunrise.

Saturn and Jupiter will pass almost directly behind the Sun on 22nd and 23rd September, and will be seen only before sunrise from about the middle of October to the end of this year.

On and about 14th November Mars and Saturn will appear to be in close proximity, and Mars and Jupiter on and about 27th November.

Venus also will be a morning star till after the end of the year.

For places west of Brisbane, but nearly on the same parallel of latitude—27½ degrees S.—add 4 minutes for each degree of longitude. For example, at Toowoomba the sun would rise about 4 minutes later than at Brisbane if it were not for its higher elevation, and at Oontoo (longitude 141 degrees E.) about 48 minutes later.

At St. George, Cunnamulla, and Thargomindah the times of sunrise and sunset will be about 18 m., 30 m., and 38 minutes respectively, later than at Brisbane.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.